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AN INVESTIGATION OF THE IMPACT OF HEADQUARTERS
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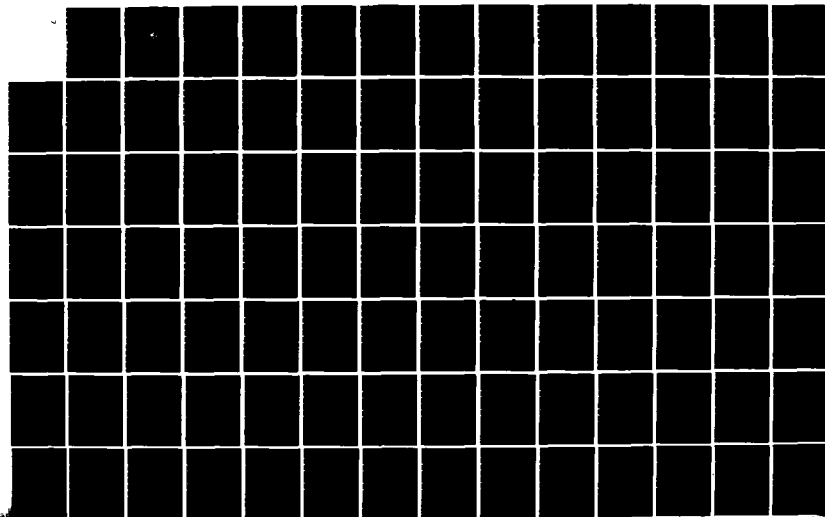
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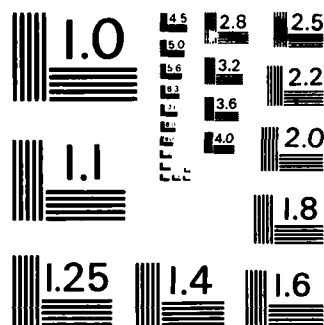
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THESIS

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AN INVESTIGATION OF THE IMPACT OF
HEADQUARTERS STRUCTURES ON THE
MILITARY COMMAND ENVIRONMENT

by

James D. Owens

and

Garland B. Brown

March 1984

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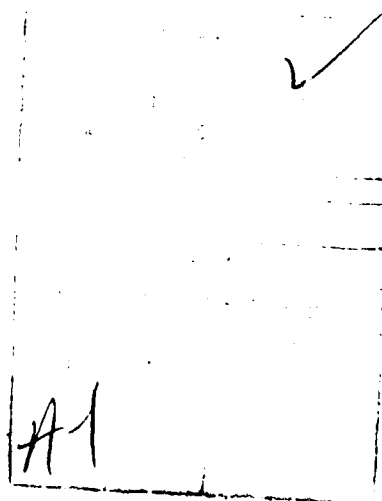
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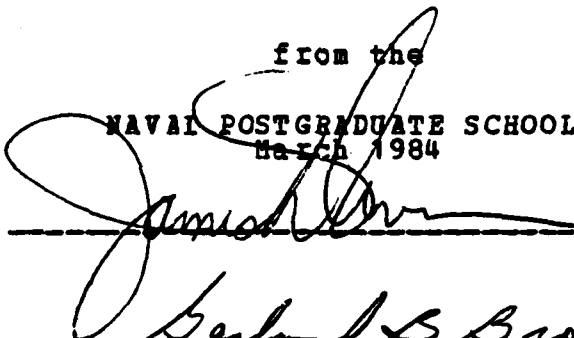
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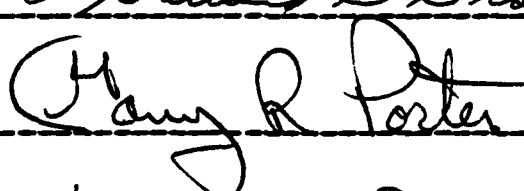
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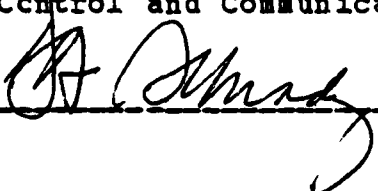
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ABSTRACT

This thesis describes an experiment conducted by the Defense Communications Agency (DCA), Defense Systems, Inc. (DSI), and the Naval Postgraduate School (NPS) during the period 31 October 1983 through 23 November 1983. Specifically, the experiment investigates how a headquarters' structure influences its effectiveness which ultimately impacts upon the speed and correctness of headquarters decisions. This was accomplished by using the Naval Warfare Interactive Simulation System (NWISS) as a transmission vehicle to pose military problems to military students using a standard scenario set and simulated headquarters networks. Although the results are not conclusive, they do tend to support a relation between different headquarters structures and the speed and correctness of decisions made by a headquarters.

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I. INTRODUCTION

A. OVERVIEW

This thesis describes an experiment conducted at the Naval Postgraduate School (NPS) during the period 31 October to 23 November 1983. The experiment was conceived, designed, conducted, and resultant data analyzed by the Defense Communications Agency (DCA), Defense Systems, Inc. (DSI), and faculty and thesis students from the NPS.

The purpose for conducting the experiment was to corroborate findings published, primarily by the Soviets [Ref. 1], which indicated that the command structure supporting a battlefield headquarters influences the headquarters' effectiveness and thus impacts upon the speed and correctness of headquarters decisions.

The experiment was conducted in the Wargaming and Research Laboratory (WAR Lab), a modern, secure computer facility. The Naval Warfare Interactive Simulation System (NWISS), a sophisticated, large scale Naval wargame was used to pose military problems to military officers serving as subjects using a selected set of simulated headquarters command structures. Selected data was collected to allow the application of the Headquarters Effectiveness Assessment Tool (HEAT) to attempt to corroborate the results of these prior studies.

The principle goals of the experiment were to (1) develop a scenario that would generate a military conflict situation requiring decision-making under time constraints; (2) enable the evaluation of different headquarters structures when a military conflict was enacted; (3) make use of modern headquarters effectiveness measures; (4) protect

against socio-economic biases, and (5) provide sufficient control, design structure, and replication of trials to permit drawing statistically significant conclusions.

The actual conduct of the experiment in the WAR Lab lasted over three weeks and required almost 1300 experimental manhours. Each of the eighteen three-hour trials required participation by a team of subjects, two support groups, a control group and a computer systems support group.

During the conduct of the experiment, data was collected against several HEAT measures. This data permitted the analysis of several hypotheses, and hence, corroboration data previously provided by the Soviets concerning headquarters structures and the decision-making process. The hypotheses which were examined were:

- Creative decisions are more likely to be made correctly by a fully connected structure, but more slowly than by less connected structures.
- A star structure makes decisions faster than other structures.
- Engagement decision errors are more likely to be made, and made sooner, by a star structure.

The findings (although not statistically significant) of the experiment were consistent with these basic hypotheses in that (1) star structures were generally faster, and (2) that fully connected structures were more often correct when making creative decisions.

B. PURPOSE OF THE THESIS

The experiment itself provided the impetus for the purpose of this thesis, which is to provide an accounting of the experiment, as well as to provide the authors with an

opportunity to actively participate in all phases (design, construction, conduct, and analysis) of a major experiment. Along with this accounting of and involvement in all experiment phases, the authors hope to provide insights and recommend changes to enhance future work in this area. Thus, the thesis documents the design, conduct, and analysis efforts associated with this experiment so that headquarters effectiveness and its impact on the decision-making process may be better understood.

C. CHAPTER SUMMARY

A brief summary of the remaining chapters follows:

- Chapter 2 presents background information leading up to the experiment and includes a description of the different types of headquarters structures, as well as previous studies and experiments.
- Chapter 3 presents the chronological evolution of events leading up to the experiment at NPS.
- Chapter 4 describes the capabilities of the NWISS, the wargame selected to support the experiment.
- Chapter 5 describes the major design features of the experiment to include the design goals, communications support model, and scenario selection and development.
- Chapter 6 provides a description of the conduct of the experiment to include organization and logistics, as well as data collection.
- Chapter 7 summarizes the experimental data analysis and discusses initial conclusions.
- Chapter 8 provides a list of recommendations for future experiments related to headquarters effectiveness and structures.

II. BACKGROUND

A. BACKGROUND ON DECISION MAKING AND HEADQUARTERS EFFECTIVENESS

The effectiveness of a headquarters is paramount to the decision-making process and may be measured by how well a headquarters successfully performs each of the following functions [Ref. 2:p.2-9] :

- Monitoring the situation.
- Developing an understanding of the situation based on available information.
- Identifying a set of alternative actions.
- Examining the consequences of each alternative action considered.
- Making a decision.
- Preparing directives and reports to communicate the decision.
- Communicating information to all concerned.

Although headquarters effectiveness is recognized as critical to the decision-making process, only limited research has been done. In fact, perhaps the most work to date has been done by the Soviets. Therefore, as a matter of introduction, a brief summary of Soviet findings will be provided.

The Soviets believe that an organization is comprised of structure, orientation (location in space or in a territory) and distribution of functions among its elements [Ref. 1:p.80]. They further believe that the foundation of

any organization is its structure, with structure being the most sensitive and flexible factor, whose alteration can have a significant effect on an organization. Therefore, many of their studies have been oriented towards the impact of structure on the decision-making process.

1. Basic Forms of a Structure

In their studies and experiments, the Soviets have identified eight different structures or linkages applicable to a headquarters organization (see Figure 2.1). These are:

- Linear. Nodes are connected one to another with no relation to command and subordination. All nodes are considered to be identical and information passed from one end to the other becomes known to all. Failure of any node denies information to the other nodes. This configuration is not considered suitable for military organizations.
- Circular. This closed-loop structure is similar to the linear structure. Two-way communications are, however, possible. It, likewise, is highly vulnerable for reasons similar to the linear structure and is, therefore, also not suitable for military organizations.
- Honeycomb. This is an extremely complex structure with many interconnections making it highly reliable. Structures such as this might be found in a single or unique headquarters.
- Multi-connection. Each node is of equal advantage and connected to every other node. This structure affords maximum rate of transmission and reliability, and best represents a distributed headquarters.
- Wheel. This is a special case of the multiconnection structure. It operates similar to a traditional

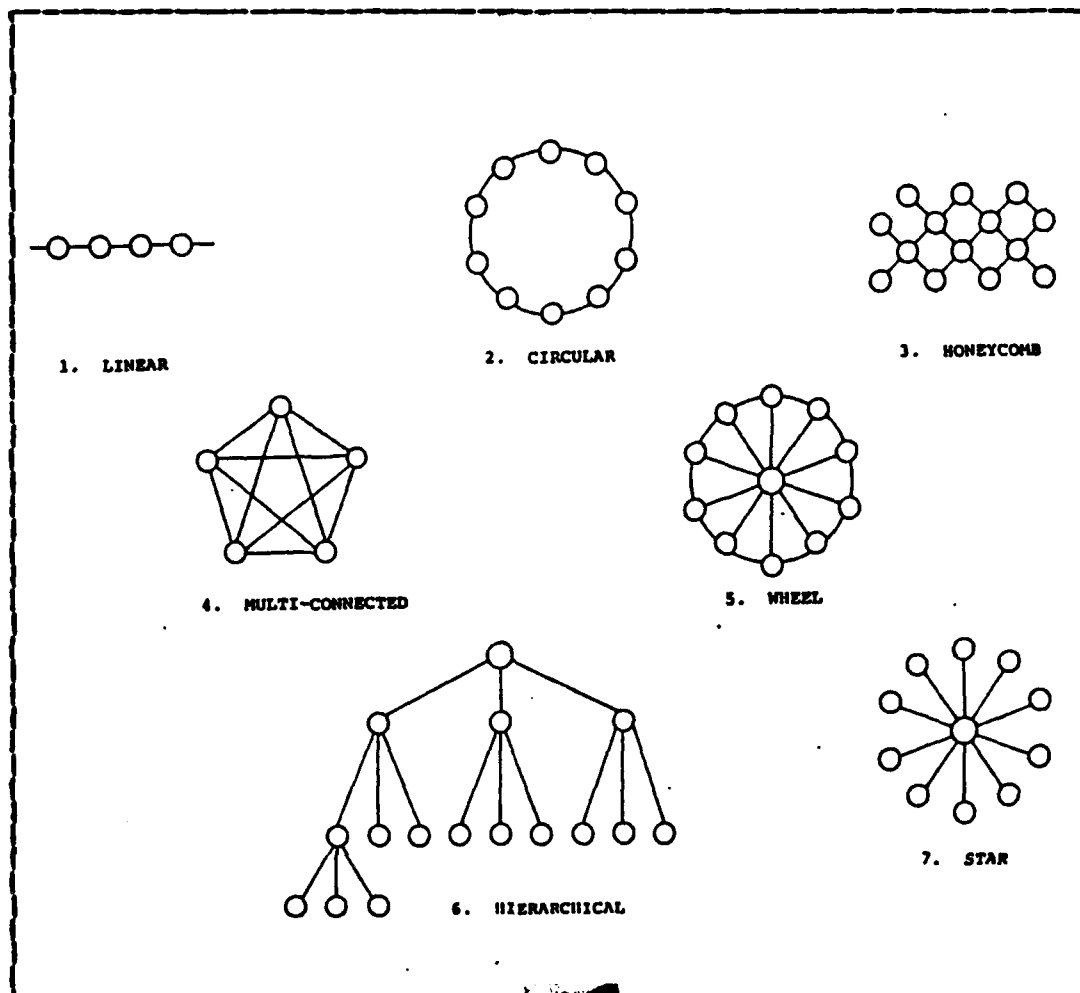


Figure 2.1 Basic Forms of a Structure

headquarters staff, with the Chief of Staff as the focal point.

- **Hierarchical.** This structure is characterized by command only positions at the top with purely subordinate positions at the bottom. As you move up through this structure, the number of connections decreases. This structure is typical of current U.S. command and control systems.

- Star. This is a special case of the hierarchical structure where command is centralized. This structure is typical of most internal staff organizations.
- Mixed Structure. Two or more of the above structures are combined.

2. Properties of a Structure

Structures may be further characterized by the following properties [Ref. 1:pp.82-86] :

- Operational Capability. The ability of the structure to react quickly to changes in situation and other stimuli. Operational capability is generally expressed in terms of time of reaction to external stimuli.
- Centralization. The ability of one of the nodes to perform essential control functions. Centralization is normally expressed as an index of the shortest routes from subordinate nodes to the central node. The higher the index, the more control the central node has over the structure and the less independent the other nodes. Generally, the hierarchical and the star structures tend to be the more highly centralized.
- Periphery. This is an expression of the structure's territorial properties with respect to the structure's center of gravity.
- Viability. This is an expression of the meaningfulness of each of the structural properties when some part of the structure is destroyed.
- Volume of Structure. Structural volume characterizes the quantitative composition of the structure and is often expressed in terms of the number of nodes which can best support an organization.

- Entropy. This is a measure of the disarray of a structure. Generally, organizations whose structures have high entropy are highly inventive but less responsive.

B. SOVIET EXPERIMENTS INVOLVING HEADQUARTERS STRUCTURES

The Soviets recognize, in combat operations, that operational decisions are made based on existing information about the enemy and friendly objectives. Unexpected situations, rapid change, and incomplete or incorrect information also effect the decision process as well. With these factors in mind, the Soviets have conducted a series of simple experiments which evaluate the decision-making process using the structures described above.

The experiments consisted of small teams performing short conventional warfare problems. The battle problems require each team to perform the following tasks [Ref. 1:pp. 116-117] :

1. Collect information;
2. Evaluate the strength of enemy forces;
3. Propose a decision to attack or defend;
4. Evaluate numerically the effectiveness of the decision.

Data was evaluated from two perspectives. First, structures were evaluated with respect to completeness and preciseness of information. Results of the experiments indicated that the star or hierarchical structures performed best when problems were stated precisely with complete information. As problems became more complex, or uncertainty increased, the star operated less effectively and structures like the multi-connected ones performed well. In fact, as information became more contradictory or

incomplete, the multi-connected structure improved. Secondly, the results of these experiments were evaluated with regard to decision type. Decisions could be categorized as formatted or unformatted. Formatted decisions are typically characterized by (1) lots of activity in a short span of time; (2) little reaction time; (3) little time for detailed coordination; and (4) making maximum use of pre-planned actions. Unformatted decisions, on the other hand, are characterized by (1) activity dispersed over relatively long periods of time; (2) responsive rather than reactive actions due to the less time dominant nature of the problem; (3) maximum coordination between participants; and (4) the opportunity for detailed, well thought out courses of action and contingency plans. The effectiveness of each type of decision, relative to each structure, can then be evaluated in terms of speed and correctness (see Figure 2.2¹).

For example, one Soviet experiment, with 20 participants in a multi-connected structure, could not solve a problem in the given four hour time limit where the star structure solved the same problem in 35 minutes. The star structure seems to be able to perform fastest of all, although the error rate is higher.

Overall, the Soviet experiments seem to favor pursuing multi-connected distributed headquarters configurations. These experiments also indicate, however, that this should be done with caution. The advantages of the multi-connected structure, particularly under conditions of complexity and uncertainty, quickly deteriorate when the number of nodes are allowed to grow, suggesting limiting the number of nodes required to work together on a particular activity. The star, which performs the fastest, develops a higher error rate, apparently as a result of overloading the central

¹Information was obtained from briefings, by DSI, presented on 13 December 1983 to students at NPS.

<u>TYPE</u>	<u>EXAMPLE</u>	<u>DECISIONS</u>			
		<u>FORMATTED</u>		<u>UNFORMATTED</u>	
		<u>SPEED</u>	<u>CORRECTNESS</u>	<u>SPEED</u>	<u>CORRECTNESS</u>
HIERARCHICAL	TRADITIONAL MILITARY SYSTEM	HIGH	MED	HIGH	LOW
STAR	INTERNAL STRUCTURE OF STAFF CELL	HIGH	HIGH	HIGH	MED-HI
WHEEL	CHIEF OF STAFF SYSTEM	LOW-MED	HIGH	MED-HI	HIGH
HONEYCOMB	UNITARY HQ	MED	LOW	LOW	LOW
MULTI-CONNECTED	DISTRIBUTED	LOW	HIGH	MED	HIGH

Figure 2.2 Structures for Decision Making

node. In conclusion, the Soviets believe that a mix of compensating communications, quality network monitoring, and Automated Data Processing (ADP) support is essential to overcome these structure related problems.

C. RECENT U.S. EFFORTS TO EVALUATE HEADQUARTERS EFFECTIVENESS

In early 1983, representatives from United States Readiness Command (USREDCOM) contacted the Naval Postgraduate School (NPS) Joint Command Control and Communications (C3) Academic Group to determine the feasibility of NPS C3 students performing an automation assessment of Joint Task Force 7 (JTF-7) Headquarters. The purpose of this assessment was to determine if JTF-7's

headquarters operational effectiveness could be improved through the automation of selected headquarters information processing segments. Five student officers at NPS are currently working on this effort as a part of their thesis research.

The approach selected by USREDCOM required observation and assessment of selected JTF-7 information processing segments during an actual military exercise, Bold Eagle 84 (October 1983). The methodology used to evaluate JTF-7's level of effectiveness was the Headquarters Effectiveness Assessment Tool (HEAT), developed by Defense Systems, Inc. (DSI), and briefly introduced below. Using HEAT, the main thrust of this study is to measure the operational effectiveness of the JTF-7 Headquarters, establish baseline measures of effectiveness, and through automation of selected headquarters information processing segments, explore the potential impacts on effectiveness.

This effort is significant since (1) it provides a current headquarters assessment case study, and (2) it makes use of HEAT as a methodology for evaluating headquarters effectiveness and the decision making process. HEAT was also the primary analytical tool selected for use in this thesis experiment.

HEAT [Ref. 3] provides an analytical link between historical analysis (i.e. the Soviet experiments) and current headquarters effectiveness studies. By applying several of its 135 available measures of effectiveness and comparing these measures against ground truth, HEAT enables observers to judge when a headquarters is performing effectively, or when it is not. HEAT measures the ability of a headquarters to effectively implement plans while adjusting for the information and assets available, precisely what the Soviet experiments and this experiment have attempted to show with respect to a particular command structure.

III. EVOLUTION OF THE HEADQUARTERS EFFECTIVENESS EXPERIMENT **AT NPS**

A. OVERVIEW

The sections which follow provide the chronological evolution that led to the conduct of a headquarters effectiveness experiment at the NPS, as well as the motivation for this thesis research.

B. SOVIET CONCLUSIONS

The Soviet experiments previously discussed continue to provide the greatest substantive data on headquarters structure and its impact on headquarters effectiveness and the decision-making process. These experiments concluded that headquarters effectiveness depends, in part, on the type of decision to be made and the command structure in effect at the time.

C. INITIAL STATEMENT OF OBJECTIVE/REQUIREMENT

Defense Systems Inc. (DSI), developers of HEAT, under contract by the Defense Communications Agency (DCA), proposed that an experimental evaluation be conducted to attempt to validate the conclusions of the Soviet experiments. Specifically, the experiment was to investigate how a headquarters command structure, as just discussed, influences a headquarters' effectiveness which ultimately impacts on the speed and correctness of headquarters decisions [Ref. 4:p.13]. Furthermore, both agencies desired that the experiment be conducted within a U.S. military context (scenario, facility, subjects) to protect against potential

biases introduced in the Soviet experiments due to socio-economic and cultural differences.

D. EXPERIMENT IMPLEMENTATION

For the following reasons, early in the planning stages a decision was made to design the experiment for implementation using a computer wargame. A simulation experiment, without man-in-the-loop was considered inappropriate due to the critical real-time decision-making interactions required. Historical analysis of headquarters effectiveness during actual conflicts was ruled out due to the lack of available recurrences of similar situations over a range of headquarters command structures. Designing and conducting a field exercise tailored to collect data to attempt to corroborate the previous findings was not feasible due to cost, time and availability of command subjects. The number of replications necessary to permit statistical analysis is large. Therefore, a computer wargame was selected as the appropriate medium to conduct the experiment.

While running a wargame is not combat and is usually not considered to be as realistic as field exercises, use of a wargame allows the conduct of an experiment in a more controlled environment, is conducive to replication of experimental trials, facilitates simple, automated data collection procedures, and is relatively inexpensive. The key is the selection of a wargame that is realistic enough for the application at hand.

E. FACILITY SELECTION

After deciding to use a computer wargame to implement the headquarters effectiveness experiment, it was necessary to select a computer facility, a wargame, and personnel to be used as subjects for the experiment.

The Wargaming Analysis and Research Laboratory (WAR Lab) at the Naval Postgraduate School (NPS) located in Monterey, California was selected for several reasons:

PROCESSING HARDWARE

VAX-11/780 with:

6 MB Main Memory
1200 MB Virtual Disk Memory
High Speed Printer
16 Terminals

BAMTEK High Resolution Graphics Systems with:

Dual Monitors
Tablets

SOFTWARE/FIRMWARE

VAX VMS Operating System with:

FORTRAN 77 Compiler
SIMSCRIPT Compiler

Graphics Tools Package (DI-3000)

Statistical Tools Package (SPSS-X)

SIMULATIONS/MODELS

NWISS (IBGTT)
JTLS
COMEL
WAAM (Incomplete)
JANUS (Replay files only)

Figure 3.1 WAR Lab Capabilities

- The WAR Lab is a modern, secure computing facility (see Figure 3.1 for a description of facility capabilities).
- The WAR Lab supports several high level wargames from which to choose.

- The WAR Lab was available during the appropriate time period.
- Military officers, as part of a course requirement, were made available to serve as expert subjects during the conduct of the experiment.
- WAR Lab staff and thesis students were available to help DSI and DCA design, conduct and analyze the experiment.
- Other students, as part of a course project requirement, volunteered to act as an experiment support group to facilitate the conduct and control of the experiment.

The NPS was also considered a conducive military environment since it is a source of graduate level education to military officers from all services, many of whom have operational backgrounds.

The wargame selected for the experiment, the Naval Warfare Simulation System (NWISS), is the subject of the next chapter.

IV. USE OF THE NAVAL WARFARE INTERACTIVE SIMULATION SYSTEM (NWISS)

Crucial to the understanding of the design of the experiment is an appreciation of the capabilities of the wargame selected, NWISS.

NWISS is a real-time, man-interactive, discrete event, time step, computer assisted simulation of the Naval warfare environment. It was developed by the Naval Ocean Systems Center (NOSC) to support and train senior Naval officers in force-level tactical decision-making and management of command and control [Ref. 5:p.1].

The NWISS wargame was selected to support this experiment since its purpose so closely paralleled the needs of the experiment. The purpose of NWISS is in part to simulate a stressful environment and the tactical information flow that battle group commanders and supporting staffs will encounter during high tempo operations [Ref. 6:p.1-1]. NWISS was also selected for these additional reasons:

- Its availability at the NPS.
- Student/subject familiarity with the wargame.
- Flexibility of this computer-driven game to support this particular experimental/wargaming environment.
- Availability of NOSC personnel to provide hardware/software assistance if required.

Briefly, the NWISS supports a two-sided (Blue versus Orange) interactive scenario where opposing sides can define, structure, and dynamically control forces ranging in size from one or more Battle Groups and associated aircraft down to a single surface or air unit. Each force's elements

and associated sensors, weapons, and communications systems may be derived from real, proposed or notional units or systems. A Control (Umpire) function is also used which directs the simulation, as well as provides user support. Blue and Orange force commanders may employ their forces as they would in battle subject to current stated rules-of-engagement (ROE) and orders, which can be violated, and availability of resources to the commander. Knowledge of the current situation is based on sensor contact reports, as well as existing friendly status of forces reports. Sensor contacts are computer simulated and provide realistic detection of enemy forces using existing sensors. The current tactical situation, called a "view," displays to the user graphically all information available to those sensors included within the view. Additionally, information is also provided via status board displays in alphanumeric format. Updates to each view are provided at least every game minute. The Control view is provided complete knowledge of all forces.

A key feature of NWISS, which was used extensively in the design of this experiment, is the processes which support this simulation. These consist of (1) the Pre-game processes (Build and Force), (2) the Wargame process, and (3) the Post-Game Analysis process. The capabilities of each of these processes will be discussed briefly.

A. PRE-GAME PROCESSES

The two Pre-game processes, Build and Force, are used to build the force database (ships, aircraft, satellites, etc.) and to populate a scenario with specific forces and initial conditions. Both of these processes are highly interactive and user friendly and were used to develop the force database and create the scenario and initial conditions required for this particular experiment.

1. Build Process

The Build process is used to literally create, verify, add, delete, and modify a force database by selecting a force element category and providing the appropriate performance characteristics (e.g. accoustics, radar and visual fingerprints, and damage probabilities), as well as the mix of systems and expendables to be found onboard (e.g. radars, sonars, jammers, weapons, buoys, etc.). To build or modify an object in the database requires selection of a force element category (see Figure 4.1) and then entry of specific values for entities of that specific force element. These values are used by various NWISS models when creating a scenario and running the wargame.

The Build process capabilities are best provided through example. Suppose the scenario requires a particular aircraft type. The user would enter the Build process and perform the following procedure:

- Select the appropriate force element category, e.g. AIR.
- Enter all appropriate force element characteristics for the particular aircraft (see Figure 4.2).

In addition to the detailed entry required for a new aircraft, each of the aircraft's subsystems (i.e. HFDF, NAV, RADAR/ESM, JAMMER, COMM, SONAR, BUOY, MISSILE, AND WEAPONS) would have to be entered as well. Any other force element types (i.e. ships, shorebases, etc.) and their subsystems would be entered similarly to create the Characteristics database file. For most applications, the Build process is not used to create a database from scratch. Normally, an existing classified database will be modified, as was the case for this experiment.

<u>Category</u>	<u>Description</u>
AIR	aircraft type
CCMMBUOY	communication buoy type
CCMMPAIR	communications path between force elements
CCMMSUITE	ccmmunication network/suite
CRUISE MISSILE	cruise missile type
JAMMER	jammer type
NAVAID	navigation aid type
RADAR/ESM	radar/ESM type
SHIP	ship class
SHOREBASE	specific shorebase
SCNAR	sonar type
SCNOBUOY	sonobuoy type
SURV/SAT	surveillance satellite type
WEAPCN	weapon type

Figure 4.1 Force Element Categories and Descriptions

2. Force Process

The purpose of the Force process is to create a scenario file for use during the execution of a wargame. The Force process allows entry of the specific instances (names, tail numbers) of ships, submarines, aircraft, shorebases, satellites, HFDF stations, and Sosus arrays that exist in the Build characteristic database. Also specified is the hierarchical task number for each force element and initial positions, ccourses, speeds, depths, and altitudes. The Force process also permits entry of communication networks, ccommand and control plans, emission control plans,

AircraftInput

NAME.....name of aircraft type
VMAX.....max speed
CLIMB.....max climb rate
AMAX.....max altitude
ASECT.....radar cross section
VCRU.....max range cruise speed
RANGE.....max range at VCRU
JP.....fuel onboard
IDELY.....launch delay
HDG.....heading sensor
SPD.....speed sensor
MNFAL.....mean time between failures
MNMNT.....mean time to complete
 unscheduled maintenance
SDMNT.....standard deviation of
 unscheduled maintenance
MNRPR.....mean time to perform
 scheduled maintenance
MAINT.....flight time between
 scheduled maintenance
RDELY.....routine service and
 refueling delay
CDELY.....change of ordinance
 delay
EBLCH.....P (successful launch)
EBREC.....P (successful recovery)
EBFAL.....P (system failure)
SYSFL.....P (system failure in two
 hours)
CATG.....aircraft type
CTRNG.....visual detection range
CLRNG.....classification range
TRKS.....max tracks held
HFDP.....**HFDP sensors
NAV.....**navigation equipment
RDESM.....**radar/ESM sensors
JAMMR.....**jamming equipment
COMMS.....**communication equipment
SONAR.....**sonar sensors
PUOY.....**sonobuoys
MISS.....**cruise missiles
WEAPO.....**weapons

** Optional entries. If selected, an object of that type must also exist in the database.

Figure 4.2 Force Element Characteristics (AIR)

pre-stored orders and contingency plans, reporting policy, search plans, and weather. These Force process entries are described in more detail in Appendix A. The Force process

also permits setting various game states to initial conditions (e.g. time, night, fatigue, seastate, etc.). Once the Force file is created, it may be modified and printed. The Force file is used as an input to the Wargame process.

B. WARGAME PROCESS

The Wargame process provides the capability to conduct a tactical warfare simulation exercise within the limitations shown in Figure 4.3. The operation of a simulated exercise is controlled through (1) acceptance and execution of orders; (2) control of platform motion, detection, and communications; (3) determination of engagement and other outcomes; and (4) display of status information and tactical situations.

These actions are accomplished by three distinct sets of player/control orders which include:

- Force control orders.
- Information display orders.
- Game control orders.

Typical commands which might be employed from each of these three order types are shown in Appendix B.

The force control orders are used to affect any of the wargame's scenario elements. An example of a force control order which might be employed is shown in Figure 4.4. Force control orders may be issued to the entire force at once, to individual platforms, or to a collective subset of the force.

Information display orders are used to make minor computations (i.e. range and bearing from one platform to another), as well as affect graphics information sent to any of the display devices. A typical information display order which might be used is shown in Figure 4.5.

- Up to 400 simultaneously active units in any combination to include the following maximums:
 - Up to 400 ships
 - Up to 50 shorebases
 - Up to 150 flights (aircraft and cruise missiles)
- Up to 20 simultaneous communications paths
- Up to 400 path members
- Up to 1000 active tracks per side
- Up to 20 sonobuoy barriers
- Up to 64 active sonobuoys per side
- Up to 64 passive sonobuoys per side
- Up to five surveillance satellites per side
- Up to 80 emitters
- Up to 40 Emission Control (EMCON) plans
- Up to 26 weather regions
- Up to 20 SOSUS regions
- Up to 20 High Frequency Direction Finding (HFDF) bases
- Up to 50 prestored orders
- Up to 30 contingency plans
- Up to 30 search plans

Figure 4.3 Wargame Capacities

Required Action: Move aircraft flight E2CA to
5000 feet.

Input: FOR E2CA ALTITUDE 5000

System Response: Flight E2CA climbs to an altitude
of 5000 feet.

Figure 4.4 Sample Force Control Order

Required Action: Center the geographic display
on FORCE KITTY.

Input:** CENTER (plot at) FORCE KITTY

System Response: The plot is centered on the
location of FORCE KITTY and will
remain centered on that location
as long as contact continues.

**Data in parenthesis represents terminal prompts
prior to data entry.

Figure 4.5 Sample Information Display Order

The Game Control orders are restricted for use by the wargame's Control personnel and are used to affect game probabilities, record game data, as well as to control the pace and duration of the game. Figure 4.6 contains a sample Game Control order.

Required Action: Control wishes to stop the game
to discuss a problem area.

Input: PAUSE

System Response: The game halts until a subsequent
GO order is issued by control

Figure 4.6 Sample Game Control Order

Two Wargame subprocesses, Automatic Status Board (ASTAB) and FLOT respond to related player/Control orders. The ASTAB subprocess permits one or more of 20 displayable status boards (see Figure 4.7) to be updated at least each game minute. The FLOT subprocess responds to graphics related player/control orders and updates all graphics displays when ordered, or at the standard game minute.

The Wargame process utilizes 15 major models to implement the interactions of ships, aircraft, weapons, sensors, communications, and environment during the conduct of a wargame. These models are listed in Figure 4.8.

C. POST-GAME ANALYSIS PROCESS

While NWISS supports a variety of post-game analysis aids, only those used in support of the experiment are discussed below (ANALYS, PRTORD, and DEBUG).

ANALYS records significant position and surveillance data at each game minute step and allows the user to obtain the following data at some user prescribed interval (e.g. every 10 game minutes) [Ref. 7:p.46] :

- Active Track Status Board
- Active Surface Status Board
- Active Scnar Status Board
- Alert Status Bcard
- Aircraft Availability Status Board
- Air Events Status Board
- Bogey Tcte/CAP Status Board
- Damage Assessment Status Board
- ESM Status Board
- Flight Status Board
- HFDP Status Board
- Intelligence Status Board
- Passive Sonar Status Board
- Reporting Policy Status Board
- Ship Status Board
- Shore Status Bcard
- Submarine Status Board
- SOSUS Status Board
- Surveillance Satellite Status Board
- Weather Status Board

Figure 4.7 Status Board Displays

- Location and status of Blue forces: including for each unit true and assumed positions, range and bearing from a user designated Main Battle unit, course, speed, altitude or depth, and time of removal from the scenario.
- Location and status of Orange threats: as above, except for assumed position.
- Blue surveillance effectiveness against Orange threats.

- Communications
- Reporting
- Sonar
- Radar
- Jamming
- ESM
- EMCON
- Visual
- Navigation
- Correlation and Tracking
- Flight Operations
- Engagement and Damage
- Surveillance Satellite
- HFDF
- SOSUS

Figure 4.8 NWISS Major Models

- Periodic summary of critical surveillance and threat events.
- Evaluation of certain command and control measures of effectiveness.

The FRTORD subprocess produces a listing of all player commands entered during the wargame and typically is used to reconstruct all or portions of a wargame session.

DEBUG provides the capability to record tracings of the interactions within NWISS models for subsequent listing and analysis.

V. EXPERIMENTAL DESIGN

A. REVIEW OF PURPOSE

As stated in earlier chapters, the purpose of the experiment was to corroborate results of experiments previously conducted by the Soviets that indicate the way a Headquarters is structured impacts on how it performs. The headquarters structures used in this experiment were evaluated with respect to two measures of headquarters effectiveness, speed and correctness. The decision stimuli, or simulated combat environment, provided the impetus for both formatted and unformatted decisions for reasons explained in chapter 2. If the decision stimuli were held constant over a variety of command structures, then the performance of the command structures for that particular type of decision stimuli could be determined.

The remainder of this chapter discusses experimental design goals, pre-design considerations, scenario concept and objectives, command structures, Composite Warfare Commander (CWC) concept, and finally, the communications model used during the experiment.

B. DESIGN GOALS

In order to achieve the objective of the experiment the following design goals were established:

- **Scenario:** Develop a scenario guaranteed to generate a military conflict situation that would cause the headquarters to make formatted and unformatted decisions under time constraints.

- Structure: The implementation of the scenario should allow for overlaying different command structures upon the scenario.
- Measurements: Develop appropriate measures that would permit analysis of headquarters effectiveness by command structure.
- Subjects: Use United States military officers as subjects to protect against the potential socio-economic and cultural biases that may have been introduced in previous experiments.
- Conclusions: Provide sufficient control, design structure, and replications of trials during the conduct of the experiment to permit the opportunity to draw statistically significant conclusions.

C. PRE-DESIGN CONSIDERATIONS

During the detailed design discussions, several factors surfaced which warranted "up front" consideration. These factors will be discussed in detail later in the appropriate design section. However, they are briefly listed below so that the reader will recognize the fact that some initial design features were a consequence of constraints and may not represent the optimum circumstances.

- The subjects for this experiment were obtained as part of a course requirement. The experiment represented only part of the total academic commitment to this course. The experiment covered approximately three weeks and each subject could be utilized only for the number of hours (15) normally devoted to the course during that three week period. Accordingly, subject utilization constraints placed a limit on total trial hours and repetitions. Any subject training also had to be incorporated as part of this overall availability.

- The students were already familiar with the Warfare Environment Simulation (predecessor to NWISS), an order of battle and general scenario in the Sea of Japan, and the WAR Lab. These factors would minimize training requirements and minimize the impacts of learning during the experiment, provided NWISS was selected as the vehicle to stimulate the subjects.
- The number of unique "views" that could be displayed in the WAR Lab was limited to five. This was due to the number of input positions supported by NWISS, as well as the number of Ramtek graphics displays available. If one position was used as a Control/Orange position, a maximum of four positions would be left to simulate the selected headquarters structure.
- The Navy uses the Composite Warfare Commander concept to delegate warfare responsibilities to subordinate commanders. Most of the students in the class were familiar with this concept. This concept, as modified for use in the experiment, involved four functional staff elements (Composite Warfare Commander (CWC), Anti-Air Warfare Commander (AAWC), Anti-Surface Warfare Commander (ASUWC), and Anti-Submarine Warfare Commander (ASWC)).

D. SCENARIO CONCEPT

In order to meet the purpose, goals, constraints, and capabilities of the experiment, a "scenario concept" was developed for implementation on NWISS. As explained in Chapter 4, NWISS supports a two-sided simulation where opposing sides (Blue versus Orange) can define, structure, and dynamically control forces. The initial force allocations and their respective starting conditions, coupled with

a geo-political environment, rules of engagement (ROE) and orders from higher authority constituted a scenario. The remainder of this section discusses the simulated political environment, as well as the forces and scenario concept which made up the two-sided simulation.

1. Political-Military Background

The time frame simulated by these scenarios is early 1984. Late in the previous year, the leader of North Korea suddenly dies and is succeeded in power by his son. Rumors explain the North Korean leader's death and succession by his son in a variety of ways. Some suspect the KGB is involved, and others think it is a normal succession of power.

In the simulation (about a week prior to scenario start) the new ruler vows to reunite the two Koreas. This announcement set off a flurry of military activity in the area and causes the U.S. to prepare to send additional air units to Korea.

One day prior to the simulation's start, the North Koreans cross the DMZ and attack South Korea. In addition, the U.S. has a carrier battle group (CVBG) conducting exercises off the north eastern coast of Hokkaido. This battle group and staff represent the simulated Blue forces. As the scenario starts, the battle group is directed to cease its exercises and proceed to the Sea of Japan via the Korea Strait. This route, somewhat round-about (see Figure 5.1), is chosen for two reasons:

- To rendezvous with supply ships enroute.
- To avoid provoking the Soviets by passing too close to their borders.

Additionally, the battle group is advised as follows:

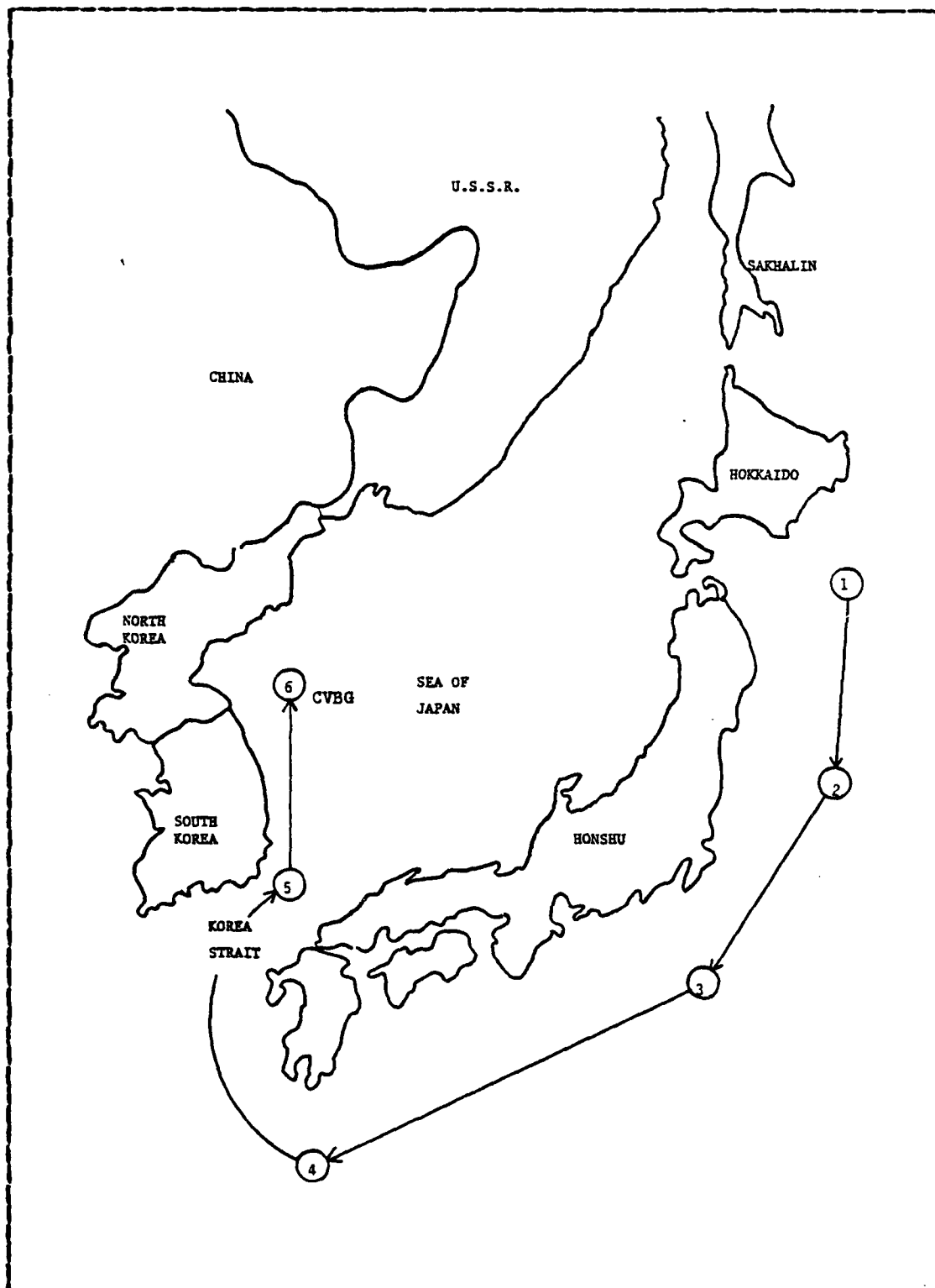


Figure 5.1 Route of CVBG to Sea of Japan

- The U.S. is contemplating using the battle group's air wing to support South Korea.
- The CVBG can defend itself if directly fired upon.
- Maintaining the air wing's combat power is an overriding priority.
- Soviet intentions, at that point, are vague. However, one of the following responses seem possible:
 - Stay out of the Korean War.
 - Help the North Koreans.
 - Attack the CVBG.
 - Attack Japan (Japan has condemned any Soviet support to North Korea and promises to support the U.S. and South Korea morally).

The battle group receives additional information as it becomes available. As a minimum, the battle group receives a daily situation report during transit to the Sea of Japan.

2. Order of Battle (OOB)

The experiment required an order of battle which, when linked with a scenario, was capable of providing sufficient time pressures on the headquarters staff and command structure to test headquarters effectiveness over the range of formatted and unformatted decision types. Based on this requirement and input from DSI, DCA, and NPS, a standard scenario order of battle (Blue versus Orange) for the Sea of Japan was developed.

The order of battle file is a static file which is created using the FORCE process in NWISS. It includes all bases and platforms drawn from the BUILD database and

assigns their initial locations, courses, and speeds. This file was the basic "building block" for all scenarios.

The order of battle consisted of one Blue Carrier Battle Group (CVBG) with a carrier air wing embarked, two

Ship Classes	24
Total Ships	55
Aircraft Types	22
Total Aircraft	255
Shorebases	5
Cruise Missile Types	10
Total Cruise Missiles	1028
Other Weapon Types	41
Total Weapon Rounds	16,961
Radar/ESM Types	77
Jammer Types	7
Sonar Types	17
EMCON Plans	12
Contingency Plans	9

Figure 5.2 NWISS entities used in the experiment

direct support Nuclear Attack Submarines, land based maritime air patrol support, one Orange carrier, two Orange Surface Action Groups (SAG), one Orange Amphibious Group, two Orange Air Attack Groups, one Orange Guided Missile Submarine Attack Group (SSGN), an Orange tattletale submarine and destroyer, and several neutral forces. Appendix C contains the order of battle used for this experiment. Figure 5.2 summarizes the entities used in the scenario to provide the reader with a general understanding of the scope of the experiment.

3. Scenario Objectives and Phases

The scenario was designed to consist of two phases, a transit phase to allow the headquarters staff time to formulate creative plans (unformatted decision types) and a high tempo operational phase more conducive to reactive (formatted) types of decisions. The planning or transit phase represented days one through five of a scenario and the execution phase represented day six.

The phases permitted a wide range of decision/reaction situations to be posed and, therefore, allowed more opportunity to measure reactions over differing intensity levels. In addition, the phases provided some additional flexibility for the purpose of trial scheduling. With each trial now subdivided into two distinct phases, a team could choose to run their trials in one of two ways:

- Run the planning phase and follow it immediately with the execution phase (one three hour session).
- Run the planning phase in one session and the execution phase during a second session (two 90 minute sessions).

NWISS provided the capability to accommodate either trial approach.

Three scenarios, each geographically set in and around the Sea of Japan, were designed to permit the evaluation of headquarters effectiveness for the different headquarters command structures. Each of the three scenarios represented a unique overall plan for the Orange forces, consistent throughout both phases and in line with each of the three scenario's unique overall objective. The general objective for the Orange forces in each scenario is as follows:

- Scenario A: Surround CVBG. Orange intent is to cut-off support to South Korea (ROK) by surrounding the Blue CVBG.

- Scenario B: Hokkaido invasion. Orange intent is to conquer ROK and Japan.
- Scenario C: Attack on SLOC. Orange, surprised by North Korea's invasion on ROK, attacks Sea Lines of Communication (SLOC) to support the invasion and win favor.

A detailed summary of the situation reports which could be used to determine Orange's intent will be presented later. At this point, it is only necessary to realize that a scenario was a simulation of military activities in a military environment in which the headquarters staff under observation used a designated command structure and was responsible for the operations of a Carrier Battle Group over a simulated six day period.

a. Planning Phase

Each scenario required the CVBG to transit from their maneuver area to the Sea of Japan via the Tsushima Strait. This transit time represented the planning phase (5 days), with each of these five days simulated as a 15 minute clock-time interval. Each 15 minute interval was initiated by a new force graphics display, updated status boards, and a daily situation report which provided the detailed intelligence necessary to anticipate and plan for conducting operations in the Sea of Japan.

When the first day of the planning phase commenced, the CVBG was ordered to provide higher authority (Commander Seventh Fleet (C7F)) with a copy of their plan of action by the end of day two. Each team received a plan format (see Figure 5.3) to ensure consistency, as well as ensure that all essential elements of information were provided for use in subsequent post-game analyses using HEAT. Additional updates to the plan, in this prescribed

1. Enemy Actions

Describe current and expected Orange (enemy) actions. Identify, objectives, schedule, and assets, if possible.

2. Own Actions

Objectives, actions, and schedule of own forces.

3. Contingencies

Address "what ifs" here. Include what you intend to do if they occur.

4. Comments

Include any other information believed necessary.

Figure 5.3 Plan Format

format, were submitted during days three through five as new information was received and digested.

During the planning phase, the NWISS wargame was running and Blue could view all of its forces each day, during the 15 minute window. Blue could also view any Orange forces subject to the capabilities of its sensors, and could also dynamically control forces; although aircraft launches, course changes and other tactical maneuvering were discouraged since each day's interval would last only 15 minutes before the geographical display for the subsequent day was reinitialized. Substantial intelligence could be gathered by adjusting the geographical display and observing the appropriate status boards.

In summary, each day of the five-day transit into the Sea of Japan during the planning phase was represented by a 15 minute real-time run using NWISS. During this period, the CVEG staff could utilize all of NWISS's capabilities to gather intelligence and information.

1. Execution Phase

The execution phase incorporated all the activities which transpired during day six of the scenario. These activities were largely dependent on which of the three scenarios were used and the "endgame" used.

Each scenario could have one of three endgames assigned (harass, attack, or provoke). The "harass" endgame resulted in the Orange air wings aggressively encircling the CVBG trying to draw fire. The "provoke" endgame had the Orange tattletale conduct a surgical strike on a CVBG unit and then depart the area. The "attack" endgame had Orange conduct a force wide pre-emptive strike on all Blue forces. The endgame concept was, in part, incorporated into the execution phase to prevent any experimental biases due to discussions between members of the student sample outside the experiment, to provide variety, and to control for learning.

The execution phase allowed maximum use of the capabilities of NWISS. Not only were the intelligence gathering activities used in the planning phase available, but now the full range of NWISS commands could be implemented.

At the beginning of day six, the appropriate scenario was initialized and the wargame was allowed to run continuously at real time. Although Orange force intentions were consistent for each scenario and endgame combination, the execution phase from Blue's perspective was basically a "free play" wargame, with team actions limited only by the Rules of Engagement (ROE) imposed by C7F.

2. SCENARIO SUMMARIES

Each of the three scenarios was designed with a unique overall Orange objective. The movement of the Orange forces was consistent throughout a scenario and based upon this

objective. The remainder of this section will outline the relevant CVBG operational information presented in the daily situation reports, which if properly analyzed, reflected the Orange force movement and intent.

The Orange and Blue initial positions for each of the six days and each of the three scenarios were specified with respect to order of battle and initial conditions. A major effort was undertaken to install these specifications, which involved converting the specifications into saved files using the NWISS wargame. The files would then reflect the proper force positioning and other characteristics called for by each of the three scripts.

Using the SAVE command, a game control order (see Appendix A for a description), 18 different "snapshots" were created to simulate the initial conditions of each of the six days of the three scenarios. Each snapshot represented a new day. The "saved file" concept facilitated the rapid update of forces between days and eliminated the need for the NWISS control team to manually reposition the many platforms used to represent the next day's locations.

The multi-scenario/endgame concept was used to control for learning over the course of the experiment, and to provide a diversity of situations on which to provide stimuli. A copy of the entire Scenario A script, provided by DSI, is provided as Appendix D to demonstrate the level of detail considered. Note that the following scenario summaries represent a substantial "sifting" of relevant information from the full blown sitreps.

1. Scenario A: Surround CVBG

Day 1:

- The KASHIN DDG follows the CVBG as it moves south.

Day 2:

- A strong Surface Action Group (SAG) sorties Vladivostok.

Day 3:

- A strong SAG is sighted off the coast of Hokkaido.
- A number of submarines (SS, SSN, SSGN) sortie Vladivostok.
- A second SAG sorties Vladivostok.
- The KASHIN DDG still trails the CVBG.

Day 4:

- The two SAGs rendezvous at 40N, 134E (middle of Sea of Japan).

Day 5:

- The SAGs are reported at 40N, 132E.
- Strike-type aircraft are observed proceeding from Soviet territory along the coast to the DPRK.
- Unidentified conventional submarines are sighted on the surface at night in the Korean Strait.
- The CVBG is through the Korea Strait.
- The KASHIN DDG still follows the CVBG.
- The CVBG is overflown by a section of Badger reconnaissance aircraft.

Day 6:

The CVBG, located in the western SOJ, is surrounded by the Orange SAGs (see Figure 5.4). The two Orange air groups are airborne nearby. One of three endgames then unfolds:

- Harass: The two Orange air attack groups circle the CVBG and then depart the area. If Blue attacks, all Orange will respond.

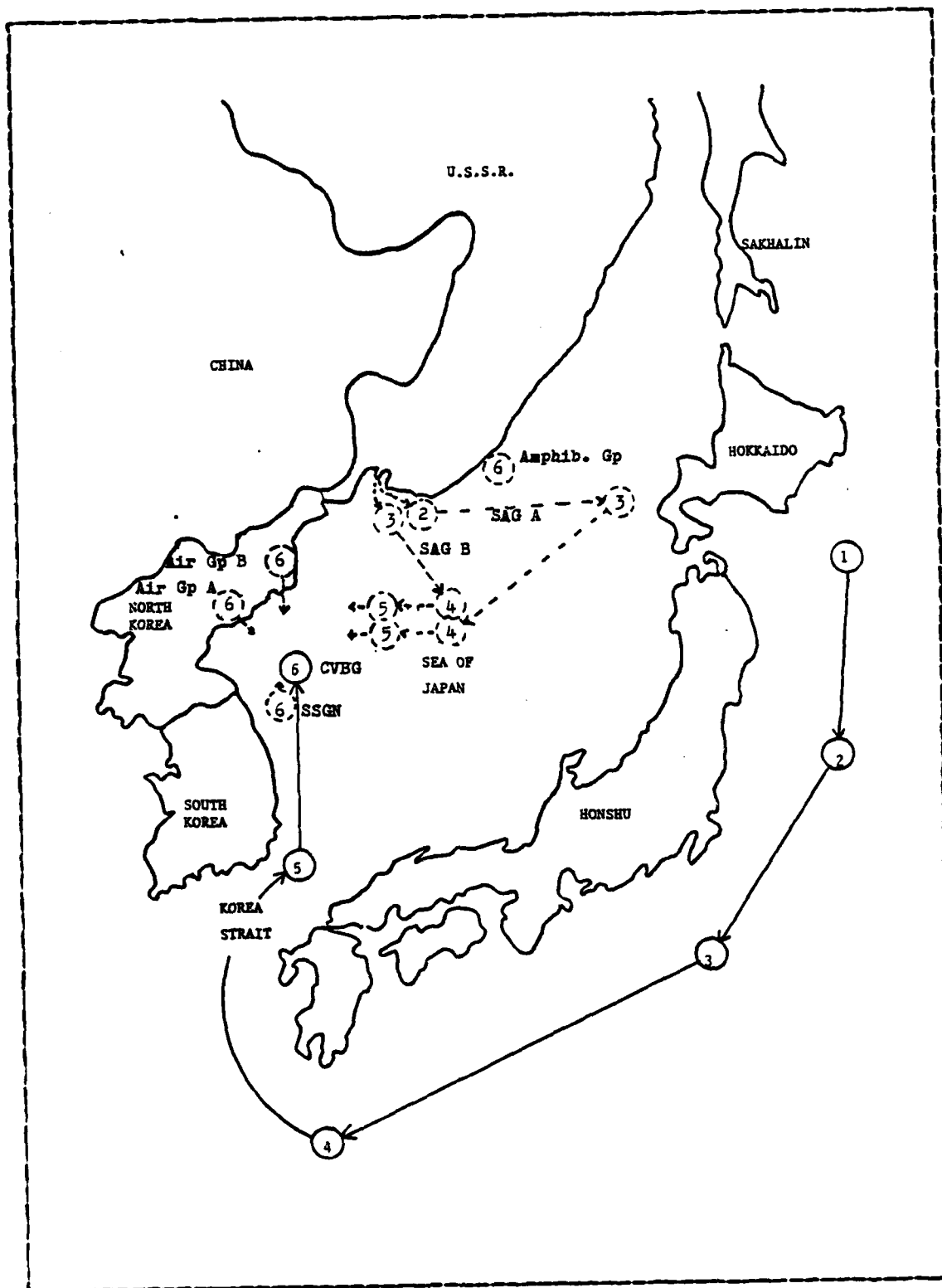


Figure 5.4 Scenario A: Surround CVBG

- Provcke: The Orange tattletale destroyer attacks the Blue CVBG and attempts to depart the area. Other Orange forces withhold fire unless the CVBG attacks.
- Attack: All Orange forces conduct a pre-emptive attack on all Blue forces.

2. Scenario B: Hokkaido Invasion

Day 1:

- The KASHIN DDG follows the CVBG as it moves south.

Day 2:

- A strong SAG sorties Vladivostok.
- The KASHIN DDG still follows the CVBG.

Day 3:

- An unknown number of SSBN's sortie Petropavlovsk.
- A strong SAG is sighted off the coast of Honshu.
- The KASHIN DDG still observes the CVBG.

Day 4:

- Seven SSBNs sortie Petropavlovsk.
- A second SAG sorties Vladivostok and heads east.
- The first SAG is now headed northeast (about 250 miles off the coast of Honshu).
- An Amphibious Group, off the Soviet coast, is now headed east.
- The KASHIN DDG still follows the CVBG.

Day 5:

- The two SAGs join and are now headed south off the coast of Hokkaido.

- The Amphibicus Group is stationary off the coast of Hokkaido.
- Strike aircraft are observed headed south from the USSR to the DPRK.
- Unidentified submarine(s) are sighted at night in the Korea Strait.
- The CVBG passes through the Korea Strait and is overflown by a section of Badger reconnaissance aircraft.
- The KASHIN DDG still trails the CVBG.

Day 6:

Both Orange SAGs and the Orange Amphibious Group are poised off the west coast of Hokkaido. The Blue CVBG is located in the central Sea of Japan. The two Orange air groups are airborne nearby (see Figure 5.5). The Soviets have conducted early-hour attacks against airfields on Hokkaido. One of three endgames unfolds:

- Harass: The Orange air groups harass without firing upon the Blue CVBG and then depart the area. If Blue fires, all Orange forces respond on all Blue forces.
- Provcke: As in harass, above, except after the Orange air groups depart the area, the Orange tattletale submarine attacks the CVBG then departs the area. If the CVBG attacks, all Orange forces attack.
- Attack: The Orange air groups pre-emptively attack the CVBG.

3. Scenario C: Attack SLOC

Day 1:

- The KASHIN DDG follows the CVBG as it moves South.

Day 2:

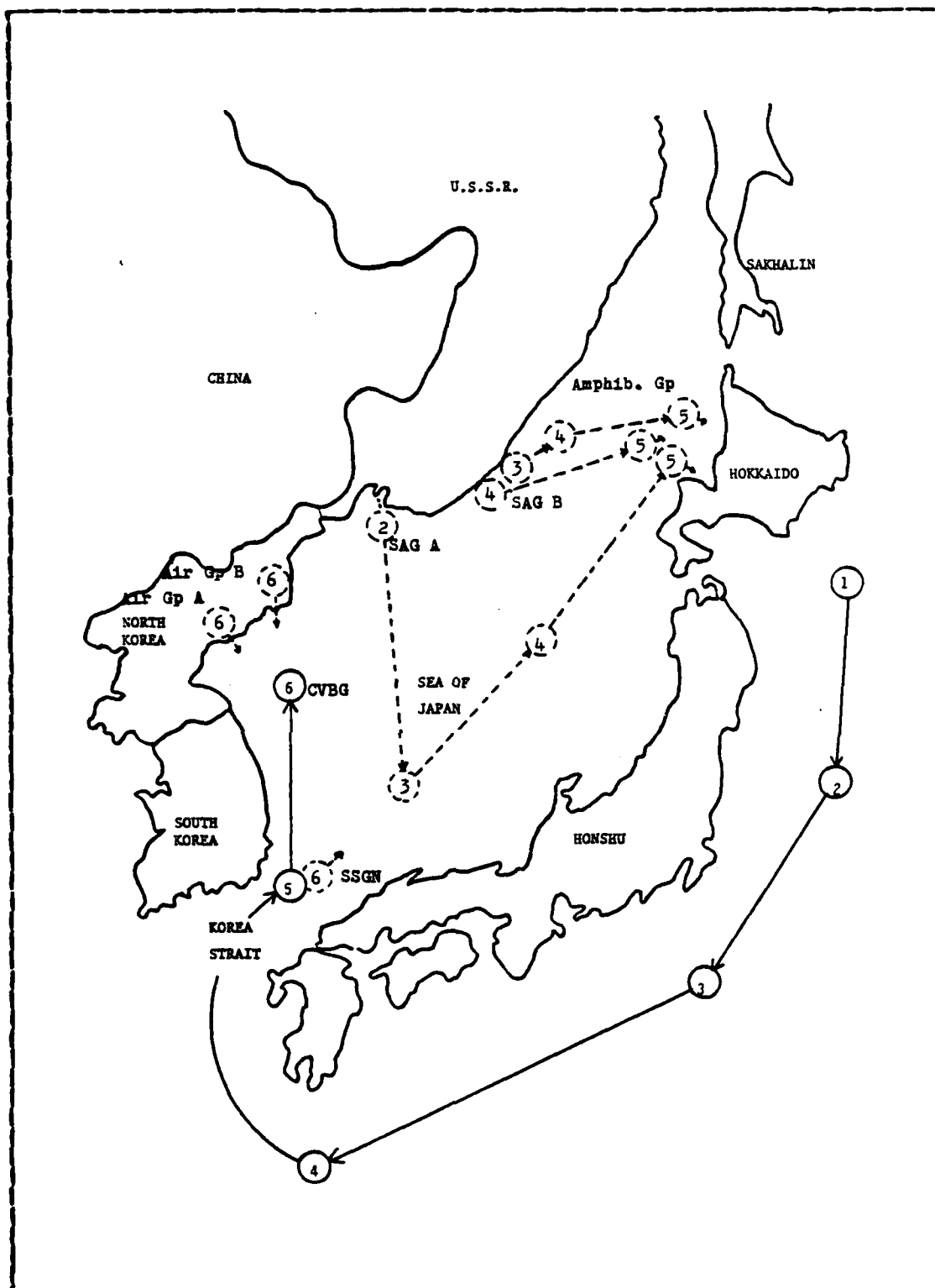


Figure 5.5 Scenario B: Hokkaido Invasion

- The two SAGs sortie Vladvistik.
- Strike-type aircraft are observed flying along the coast from the USSR to the DPRK.
- The KASHIN DDG still observes the CVBG.

Day 3:

- The KASHIN DDG still follows the CVBG.

Day 4:

- SAGs A and B move around in the middle of the Sea of Japan.
- The Amphibious Group is about 100 miles off the coast of the USSR.
- Several contacts on snorkeling and nuclear submarines are made in the Sea of Japan.
- The KASHIN DDG still follows the CVBG.

Day 5:

- The CVBG is overflown by Badger reconnaissance aircraft.
- SAG A is about 100 miles off Korea.
- SAG B is about 200 miles off Honshu.
- The Amphibious Group is sighted about 100 miles from Hokkaido.
- The KASHIN DDG still trails the CVBG.

Day 6:

SAG A moves south and is now approaching the Korea Strait (see Figure 5.6). SAG B moves north and has joined the Amphibious Group off the coast of Hokkaido. The entire Sea of Japan area is covered by Soviet reconnaissance aircraft. The KASHIN DDG is still around and has intensified its activity. One of three endgames then unfolds:

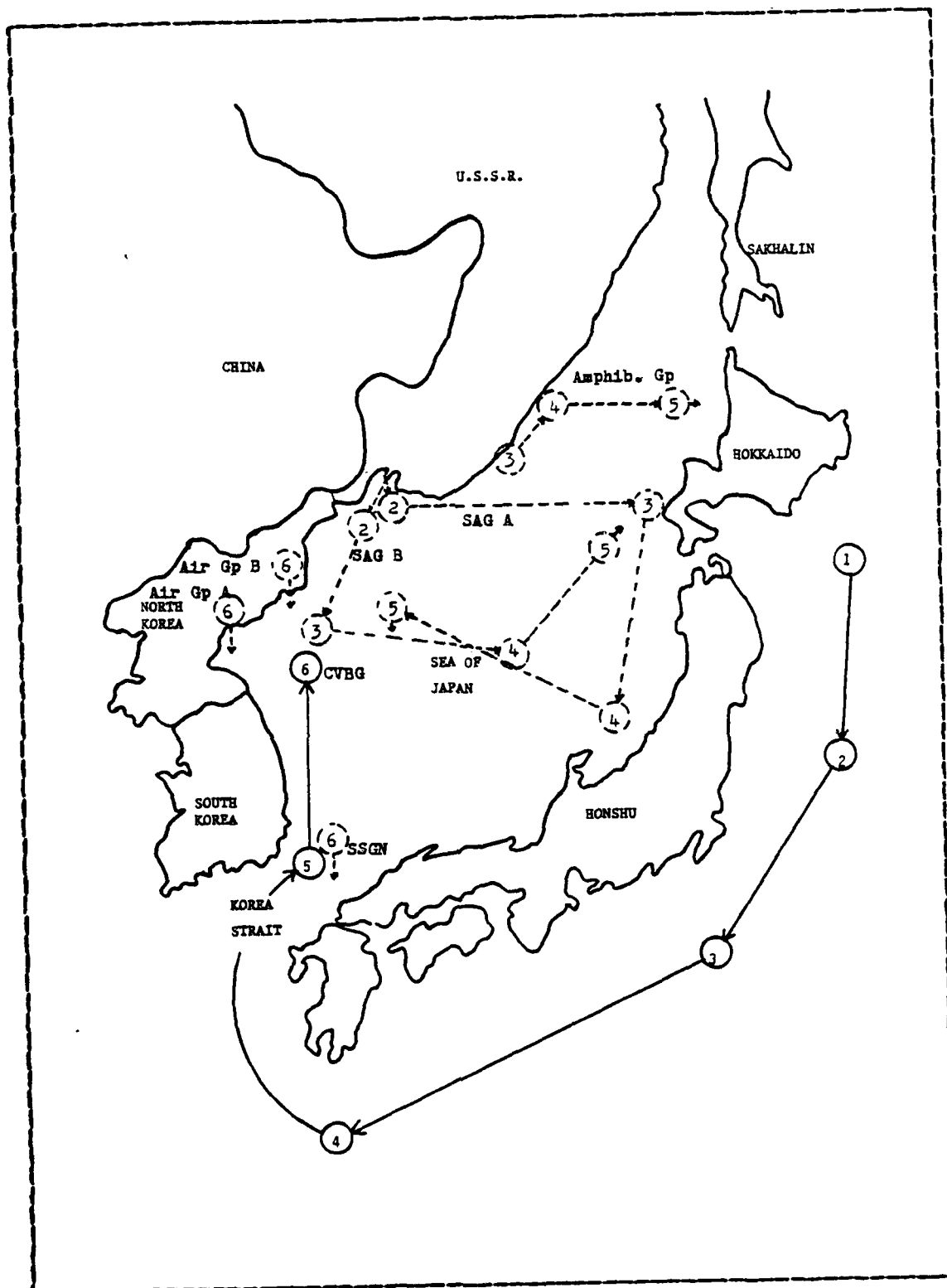


Figure 5.6 Scenario C: Attack on SLOC

- Harass: Orange air groups fly around the CVBG. If attacked, all Orange units attack the CVBG.
- Provoke: The SSGN attacks merchant shipping in the SLOC. If the CVBG engages any Orange unit, other than the SSGN, all Orange forces attack.
- Attack: The SSGN attacks merchant shipping in the SLCC. Five minutes later, a White (neutral) submarine attacks the CVBG. Orange forces respond only if attacked.

F. ORANGE SCRIPT

In order to standardize the response of the control (Orange) team during the "free play" (execution phase) period, a methodology had to be developed to present each of the different scenario/endgame combinations just discussed. It was decided that a scripted checklist would meet this requirement. Since there were three unique scenarios and three endgames for each scenario, nine unique checklists were required. Appendix E contains one of the checklists to demonstrate the extent to which Orange force actions were controlled.

Thus far, this chapter has been concerned with scenario concepts, order of battle, and the implementation of the scenario. The remainder of the chapter concerns the issues of command structure and the procedures chosen to measure headquarters effectiveness.

G. COMMAND STRUCTURE

Three of the eight structures identified in the Soviet studies were selected for this experiment. It was felt that these three particular structures were representative of the structures used in the Soviet experiments, as well as those structures which might be encountered in a U.S. military

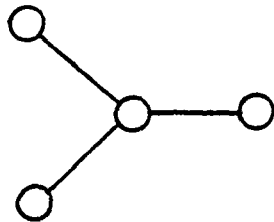
environment. The two primary structures selected were the "star" and "fully connected" (multi-connected). It was also realized that structures used in an actual military environment might not be so precisely symmetric. In this light, an additional structure was selected which was a compromise between the star and the fully connected structure. This "partially connected" (mixed) structure could be viewed as a fully connected structure missing a link between two nodes, or participants, to the structure.

The three structures used for this experiment are depicted in Figure 5.7. The logical connection between nodes is represented by a communications link between those nodes. Note that in the star structure, all logical connections must go through the central node. In the other structures, if a logical link exists between two nodes, they can communicate directly without going through another "routing" node. Additional characteristics of all three structures, as discussed in Chapter 2, apply.

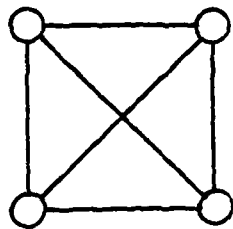
H. CCNPCSITE WARFARE COMMANDER (CWC) CONCEPT

In conducting an experiment to measure the effectiveness of headquarters structures, it was necessary to use a command and control concept that would fit the structures selected and be compatible with the NWISS wargame. Therefore, the Navy's Composite Warfare Commander (CWC) concept was adopted. In addition to fulfilling the structure and wargame requirements, the CWC concept was also suitable to the experiment subjects, since most were Naval officers familiar with the concept.

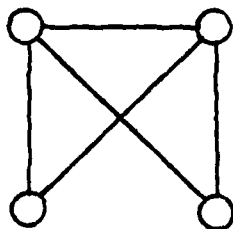
The concept, due to previously discussed limitations, consisted of four staff elements (Composite Warfare Commander (CWC), Anti-Air Warfare Commander (AAWC), Anti-Surface Warfare Commander (ASUWC), and Anti-Submarine Warfare Commander (ASWC)).



STAR



FULLY CONNECTED



PARTIALLY
CONNECTED

Figure 5.7 Structures

A brief summary of the individual warfare commander responsibilities and functions used in the experiment is provided in the following subsections [Ref. 7: p.5-8].

1. Composite Warfare Commander (CWC)

The Composite Warfare Commander promulgates plans and policies as they pertain to the battle group and delegates authority to warfare commanders. The CWC functions include:

- Prime coordinator for power projection strikes ashore and close air support missions for land combat forces.
- Assignment of assets to anti-air, surface, subsurface, strike or CAS missions.
- Obtains external intelligence support.
- Coordinates with higher authority.
- Gives launch authority.
- Sets rules of engagement (ROE) and EMCON.
- Preparation and transmission of messages to higher authority and to subordinates regarding status of forces, engagements, damage assessments, operations plans, and other activities affecting the battle group.

2. Anti-Air Warfare Commander (AAWC)

The Anti-Air Warfare Commander is responsible for the defense of the Carrier Battle Group from a coordinated aircraft missile attack by one or more air, surface, or subsurface units. AAWC functions include:

- Engagement of air targets during AAW task group operations in coordination with other forces.
- Airborne anti-air operations.
- Control of combat air patrol (CAP).

- Launch of anti-air warfare aircraft when authorized.
- Engagement of air targets using installed air-to-air and surface-to-air weapons systems.

These functions are accomplished by:

- Designation and assignment of AAW forces.
- Detection, classification, identification, and tracking of potential air targets.
- Launch, control, and coordination of AAW activities including CAP, SAM, and guns.
- Preparation and transmission of messages regarding status of forces, engagements, damage assessment, and other AAWC activities.

3. Anti-Surface Warfare Commander (ASUWC)

The Anti-Surface Warfare Commander is responsible for the detection, tracking, and offensive/defensive engagement of surface platforms. ASUWC functions include:

- Designation and control of air, surface, and subsurface war-at-sea strikes against surface forces.
- Conduct of surface surveillance by air, surface, and subsurface units.
- Coordination and control of air, surface and subsurface engagements with enemy surface forces.

These functions are accomplished by:

- Designation of anti-surface ship patrols and barriers.
- Engagement or attacking.
- Air operations in support of anti-surface operations.
- Employment of surface-to-surface missile systems.

- Preparation and transmission of messages regarding status of forces, engagements, damage assessment, and other ASUWC activities.

4. Anti-Submarine Warfare Commander (ASWC)

The Anti-Submarine Warfare Commander is responsible for the detection, classification, tracking, and attack of subsurface platforms. ASWC specific functions include:

- Performance of passive submarine detection.
- Screening operations.
- Operation of barrier units against submarines.
- Airborne anti-submarine operations, both land and sea based.
- Air operations, both land and sea based, in support of airborne ASW operations.
- Engagement of submarines in cooperation with other forces.
- Control of aircraft involved in ASW operations.
- Launch of ASW aircraft when authorized.
- Engagement of submarines with ASW armament.
- Passive/active submarine defensive actions.
- Coordination of sea and shore based ASW operations.

These functions are accomplished by:

- Designation and assignment of organic ASW forces, and coordination with non-organic forces.
- Control of air, surface, and submarine platforms in search of hostile submarines.
- Control of attacks against a submarine contact.

- Preparation and transmission of messages regarding status of forces, engagements, damage assessments, and other ASWC activities.

I. COMMUNICATIONS MODEL

1. Background

As indicated earlier, the objective of the experiment was to examine the impact of command structure upon headquarters effectiveness as measured by the speed and quality of decisions made by the headquarters. The headquarters for purposes of this experiment was viewed as a network. Early in the design discussions it was realized that the experiment would require some fairly rigid or controlled mechanism to model different command structures, as well as record interactions between the various links. The specific aspects of the network structure which were of most concern were connectivity and centrality.

Since NWISS and the WAR Lab were chosen as the vehicle to implement the experiment, any communications model of a headquarters structure had to be accomplished within the confines of the WAR Lab. Several existing communications models were considered.

The first method considered to provide this connectivity or internal headquarters communications was a voice or intercom system. This method was quickly discounted as being impractical for this experiment due to cost and lack of available devices.

The next method considered was the existing mail utility program provided with the VAX system in the WAR Lab. Each node within the network could have been provided with a terminal and mail box; then each position would have been able to communicate with any other staff members through the mail. The problem with this methodology was that without

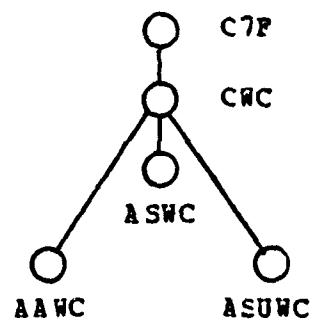
extensive system program modifications there would be no control over connectivity. As an example, the system only checks for valid accounts and the experimental structure being exercised would not have been controlled by the system.

2. Communications Model Specifications

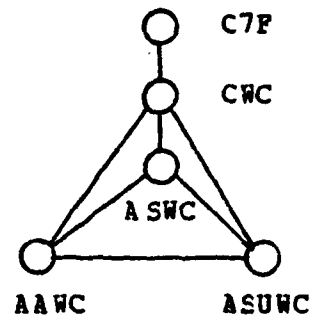
It was concluded that the experiment would require a mail program unique to the situation. The program would have to enforce the structures chosen (see Figure 5.7) and would have to guarantee that only valid addressees for the particular structure being exercised were used. In addition to the structures chosen, the model had to facilitate a link between the battle group and the simulated higher headquarters (C7F). This requirement was incorporated into the required structure and is depicted in Figure 5.8 along with CWC staff elements. Note that while the geometry of the command structures depicted in Figure 5.7 is different than figure 5.8, with the exception of the line to C7F, the topologies are identical.

Thus, specific requirements were developed for the communications model. These requirements are detailed below:

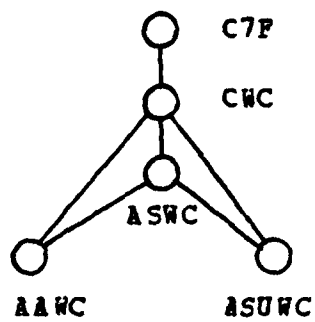
- The model should allow selection of one of three command structures.
- It should enable modeling five nodes.
- The model should rigidly control the communications between nodes in accordance with the command structure selected.
- It should display messages received on the commander's mail terminal (CET).



STAR



FULLY
CONNECTED



PARTIALLY
CONNECTED

Figure 5.8 Experimental Structures

- It should provide the capability to receive a message for later viewing while processing a message for transmission. This would require a buffering capability.
- It should provide a duplicate hard-copy of all messages received for subsequent reference.
- The model should provide a capability to preclude messages received from scrolling off the CRT screen before the commander is finished viewing it.
- It should provide the capability to record all message traffic between the various staff members to facilitate post-game analysis.
- The model should provide accounting features to facilitate the analysis effort.
- It should also provide some indication to signal when a new message was displayed on the CRT to eliminate the need for having to "watch" for incoming traffic.
- Finally, the model should be user friendly.

3. Implementation of Specifications

The intent of this discussion is to provide a general appreciation of how the model satisfied the specifications. The program provided by the authors satisfied all of the specifications and proved to be an excellent method of simulating and controlling the different communications structures.

The communications program was written in FORTRAN using the VAX/VMS system located in the WAR Lab at the Naval Postgraduate School. Since a major part of the program involved interprocess communication and synchronization, which are best served by the system, system directives and utilities were used extensively.

A menu was incorporated into the program to facilitate selection of the command structure (Star, Fully Connected, or Partially Connected), position (C7F, CWC, AAWC, ASWC, or ASUWC), and subject group (A, B, C, D, E, or F). Based on the structure and position being simulated the program could then refer to an internal "address verification/selection subroutine" to control communications between nodes.

The first node to initialize created mail boxes for all five nodes. As the other nodes were initialized, they established logical connections to these mail boxes. The length of the mail boxes was specified so as to allow multiple messages (a maximum of five) in a node queue. This insured a buffering capability of up to five messages. These parameters could have been adjusted to permit a longer queue. However, with a small number of nodes, a buffering capability for five messages was sufficient. Although each node had a logical connection to all other nodes, the structure being simulated determined if a particular link could be used. This check was part of the address verification subroutine.

Each message sent over a link was also sent to a central printer. These messages were delivered to the addressees and this copy served as a reference copy. Meanwhile, the mail box utility program on the VAX sent an interrupt to the appropriate node's mail process. The process would then automatically read its mail box and display the received message on the commander's mail terminal (CRT).

As with the central printer, each message was also sent to a disk file. This file was used to obtain a chronological sequence, by position, of the communications after each trial. Each message contained header and trailer lines which were automatically created by the mail process at the

origin node. One entry in the header line was a bell character. When this character was sent to the terminal, an audible bell sounded which indicated a new message had been displayed.

After a message was displayed, the process would ask the operator to signal the process by hitting a carriage return. This scrolled the current message off the screen and insured that messages could be displayed at the commander's desired pace.

In addition to the bell in the header, each message indicated sender, receiver, structure being simulated, subject group, game time, and real time. This information facilitated post-game analysis (see sample message traffic in Figure 5.9). For example, given the real time and subject group, messages could be related to a particular scenario and endgame combination using the master schedule.

User friendliness was provided by error checks to insure appropriate addresses were entered. When input from the terminal was required, a prompt of valid responses was provided. And finally, the process automatically entered the "from", "real-time", and other accounting information transparent to the operator.

The communications program was the only authorized means of communication between the subjects. The model, under software control, maintained the integrity of the structures being simulated.

J. MEASURES OF EFFECTIVENESS

As previously discussed, HEAT was the selected methodology used to collect and analyze the data. The primary emphasis was on measuring the headquarter perception of ground truth and how well the headquarters plan of action performed over time. Chapter 7 details the analysis with respect to these areas of emphasis.

TO: C7P FROM: CWC (STAR) GP: A
ENEMY INTENTIONS
ESTIMATE ENEMY WILL ATTK CVBG WITH BOMBERS AND
SHIES TO PREVENT US FROM SUPPORTING THE SOUTH
KOREANS.

OUR ACTICNS
WILL PCSITION CVEG AT APPROX 37N 132E. WILL
USE SUBS TO PATECL STRAITS (OMAHA) AND PROVIDE
BARRIER COVER TC CVBG (LOSAN). NEED CONTINUED
P3 SUPPORT IN SOJ, NEED THE P3 ASSETS CHOPPED
TO ME. UPON ARRIVAL, WILL LAUNCH CAP OF F14
AND E2 FOR AIR DEFENSE AND SURFACE SURVEILLANCE.
WILL CCNTINUE NCHMAL EMCON STATUS CONTINGENCIES.

CONTINGENCIES
BEING TRAILED BY UNKNOWN SUB CONTACT ASSUMED
ASSUMED HOSTILE. WILL MAINTAIN CONTACT AND
ATTACK AS PERMITTED BY ROE.

COMMENTS
EXPECT TO ARRIVE SOJ ON SCHEDULE.
GAME TIME: 030042Z REAL TIME: 8-NOV 13:58:04
BT

TO: C7P FROM: CWC (STAR) GP: A
ACTION: AAWC, ASWC, ASUWC

COMMENT CN INITIAL PLAN ONLY IF CHANGES REQUIRED.
GAME TIME: 030044Z REAL TIME: 8-NOV 14:00:37
BT

TO: ASUWC FROM: CWC (STAR) GP: A
ACTION: ASUWC, ASWC

2 P3 WITH 4 HRPON AND 4 MK46 ARE CHOPPED TO EACH
OF YOU EACH DAY (TCTAL OF 4 PER DAY).
USE AS BEST SEE FIT.
GAME TIME: 040224Z REAL TIME: 8-NOV 14:02:44
BT

Figure 5.9 Sample Message Traffic

K. DESIGN RESPONSIBILITIES

As can be seen, the total design requirements for this experiment were quite extensive. Therefore, in order to successfully complete the experiment, specific responsibilities were delineated to the primary participants. These responsibilities are summarized in Appendix F.

VI. CONDUCT OF THE EXPERIMENT

A. OVERVIEW

This chapter discusses the lab structure used during the experiment, the participants involved, a typical trial, scheduling and sequencing the trials, the total man hours required during the experiment, and a summary of the actual conduct of the 18 trials. In addition, data collection techniques used during the experiment are discussed briefly.

B. ORGANIZATION AND LOGISTICS

1. Lab Structure

For purposes of the experiment the WAR Lab supported five NWISS stations, or positions. Each station had assigned to it a Ramtek graphics display, two terminals for interacting with the NWISS wargame (one to view status boards and the other to input player commands), and one communications terminal for communicating with the other nodes in accordance with the command structure selected. Figure 6.1 depicts the location of each station, as well its complement of equipment. The four Blue warfare commander positions (CWC, AAWC, ASUWC, and ASWC) had an identical complement of terminal and display devices. The fifth position (Control) served as the overall experimental control position which represented the Blue Battle Group's opposition (Orange forces control) and also served as the simulated link to higher authority (Commander Seventh Fleet and National Command Authority). In addition to the normal equipment located at a Blue station, the Control position had an additional terminal to run the wargame process, and a



portable room divider. Both prevented one station's commander from viewing another station's displays. Additionally, they served as sound barriers to reduce the possibility of one station "overhearing" another.

NWISS graphics presented on the Blue Ramtek monitors included friendly forces, classified enemy forces, lines of bearing to detected emitters, and geographical landmass boundaries. The NWISS graphics presented at the Control/Orange station displayed all forces (ground truth) in addition to landmass boundaries. All units were updated each game step with a game step usually corresponding to one minute of real time. The platforms were displayed using standard Naval Tactical Display Symbolology (NTDS). Symbols were redundantly color coded to distinguish tracks designated as hostile, neutral, or friendly. Using the NWISS Information Display Orders, geographical areas could be displayed at radii of one to 4095 miles, keyed on any platform, location, or track. The display could be used to view the big picture (the entire Sea of Japan and more for instance) or to display a particular platform and its relative spacing to the surrounding platforms.

The player terminal was used to input commands to forces and manipulate the graphics display. Typically, this terminal was used to regulate EMCON, fire weapons, launch and load aircraft, set courses and speeds, and orient the graphics display. A representative sample of commands used is in Appendix B.

The status terminal was used to retrieve information. From the status terminal the user could "call up" or display any of 20 different status boards (see Figure 3.7) being continuously updated by NWISS. The display of interest would be based on the current environment. For example, if incoming hostile air was expected, the "Bogey Tote" status board might be viewed, or if a player was interested in

enemy submarine detections, the "Passive Sonar" status board could be viewed.

The wargame terminal, at the control station, was used to actually initialize and run the NWISS wargame. NWISS permitted selection of run time parameters to allow a running trace of the damage model and the engagement model portions of NWISS to be displayed on the wargame terminal and be sent to a file for post-game analysis. Additionally, the ability to observe such detailed engagement and damage traces proved invaluable to the control team. By monitoring the evolution of a scenario, the control team could ensure that the objectives of the scripted opposition were realized.

Each station was also equipped with a communications terminal. This terminal was the only authorized means of communication between warfare positions. Prior to each trial, the control team initialized the communications program for each of the five terminals to include the structure being simulated (Star, Fully Connected, or Partially Connected) and position (CWC, AAWC, ASUWC, ASWC, or C7F). For analysis purposes, one of six teams (A, B, C, D, E, or F) was also specified. When a user wanted to send a message, he would "wake the program up" with a carriage return. The communications program would then provide the user with a menu of authorized addressees based on the structure being simulated and the position which this terminal was representing. After a valid address was selected, the program would prompt the user for the message to be sent. After sending the message, the program would then "go back to sleep" and await either an incoming message or user request to send another message.

The C7F communications terminal (Control) provided a link to the battle group's CWC position for all structures simulated. This link was deemed necessary to pass rules of

engagement and to receive the battle group's plans. Additionally, this link provided for automatically capturing this information to be used for later analysis.

2. Personnel

A total of 58 personnel were used during the conduct of the experiment. These personnel included (1) members of the subject teams, (2) control team personnel to include experiment facilitators, and (3) other support personnel required to maintain a controlled environment. A brief description of these teams and their responsibilities follows.

a. Subject Teams

Six teams of four military officers, each from the NPS C3 and Space Operations curricula, were provided as subjects. Participation in the experiment was part of a course entitled "C3 Systems Evaluation." During each experimental trial, each of the four members would assume one of the warfare positions. To control for learning, the team members were rotated for each trial so that no team member ever played the same position more than once.

The teams were responsible for monitoring the global-political, and military situation as reported in the daily sitreps. In accordance with this intelligence and the ROE's provided by C7F, they were to plan for and conduct operations on a battle group level.

b. Control Team

The control team consisted of 12 to 14 personnel as follows:

- Thesis Students (2): During the conduct of the experiment, these students acted as Commander Orange and provided spirited, scripted opposition to the Blue

force. They assisted in the delivery of hard-copy message traffic to the warfare commander positions, and initialized daily snapshots during the six day simulation. In addition, they assisted in the initialization and operation of the wargame.

- DSI Evaluators/Observers (2 to 4): These evaluators and observers conducted pre-trial and post-trial briefings and collected data during the course of the trials. The senior DSI representative normally served as C7F and provided ROE guidance when necessary. They also delivered daily situation reports during each of the eighteen trials.
- WAR Lab Director (1): This individual served as primary operator and monitor for the NWISS wargame. He assisted in the trial startup procedures and served as the overall consultant/facilitator from a NPS perspective.
- Lab Managers (2): These individuals were responsible for computer system monitoring and fine tuning as required. They also assisted in the timely restarts of NWISS "hung" terminals.
- DCA Representative (normally 1): This individual was part of the DSI/DCA observer team and was the primary operator of the Polaroid 35mm slide apparatus which permitted real time documentation of Ramtek graphics display information. He also served as the overall experiment consultant from a DCA perspective.
- Facilitators (4 from a pool of 8): These individuals were the impartial player terminal operators at each of the warfare commander positions. They served as the interface between the warfare commander and NWISS. They provided a timely translation of the warfare commander's

orders into NWISS orders and made the appropriate keyboard entries. This permitted the commander to concentrate his efforts on monitoring his own force status, reading mail, and issuing verbal commands to the input operators.

c. Other Support Personnel

During the execution phase of a trial, each of the Blue positions had a volunteer communications terminal operator. These personnel were also from the C3 Curriculum and were motivated to be involved primarily because of possible follow-on thesis work and an early introduction to wargaming. These volunteers minimized any impact on the commander of communicating through the written form. As with the player terminal personnel, the communications terminal operator freed the commander of any requirements for keyboard entry and allowed focusing attention elsewhere.

3. Typical Experimental Trial

In order to maintain maximum control and reduce any confounding factors from trial to trial during the experiment, a chronological sequence of events, representing a trial, was developed. The chronological sequence of steps which was used to control and present a trial is as follows:

- a. Pre-brief the subjects.
- b. Initialize the wargame to Day 1.
- c. Distribute the sitrep for Day 1.
- d. Request an initial plan of action no later than the end of Day 2.
- e. Run the wargame for 15 minutes.
- f. Update the wargame for the next day's snapshot.
- g. Distribute the sitrep for this snapshot.

- h. Request a plan update based on the last sitrep.
- i. Run the wargame for 15 minutes.
- j. Repeat steps f through i for Days 3, 4, and 5.
- k. Subjects take a short break to allow a transition to the execution phase of the trial (approximately 90 minutes of real time had elapsed at this point).
- l. Update the wargame to Day 6 while subjects are on break.
- m. Distribute the sitrep for Day 6.
- n. Send a message to clarify any new ROE.
- o. The execution phase is then played for approximately 90 minutes. The Orange force (Control) follows the script for the scenario and endgame combination for that trial.
- p. Participants are debriefed.
- q. All data files for the trial are printed out.

4. Scheduling and Sequencing of Trials

Prict to conducting any trials, the subjects were required to attend an NWISS training session. A "non-experiment" scenario was used to facilitate this orientation. The eight control team facilitators were the first group to receive this training session since they were expected to assist in the orientation and training of the primary teams. These training sessions were approximately two hours in duration. Again, the intent was to get the prospective warfare area commanders familiar with the order of battle, message system, and general mechanics of NWISS in order to prevent the impact of learning on the results of the experiment.

As previously discussed, the experiment was designed to consist of eighteen trials (six teams and three scenarios per team). A total of 15 hours per student was available. Six hours were already used for lectures and training. Therefore, nine hours remained, three hours for each trial. As always, there was a trade-off between the number of trials and cost in terms of time and resources.

Another major concern in conducting the experiment was to avoid any bias in scenario, team composition, and command structure matches. With this objective in mind, DSI used a statistical methodology to assign an experimental sequence, considering the particular scenario, structure, and team mix. Figure 6.2 depicts the resulting trial

Group A	Group B	Group C	Group D	Group E	Group F
AX	CY	BZ	BX	AY	CZ
BY	AZ	CX	CY	BZ	AX
CZ	BX	AY	AZ	CX	BY

Scenario A = Attack on Battle Group
 Scenario B = Invasion of Hokkaido
 Scenario C = Sub Attack on SLOC

Structure X = Star
 Structure Y = Partially Connected
 Structure Z = Fully Connected

Figure 6.2 Experimental Trial Sequence

sequence. Note that each team had three trials and did not play the same scenario/structure mix more than once.

Teams were given the latitude of selecting their trial times from a centralized master schedule. All hours between 0800 and 2100 were made available except for scheduled system maintenance and class conflicts. Once the teams

selected their trial time, facilitators and communications terminal volunteers were signed up to support that trial time. The sign up schedule was also monitored by the control team. A hardcopy schedule was prepared each week and provided to all concerned. A copy of the schedule is provided as Appendix G in order to reflect some of the logistics involved in scheduling and coordinating the eighteen trials.

5. Conduct Assessment

We believe that all objectives during the experiment's conduct were achieved. Seventeen out of the 18 scheduled trials were successfully conducted, with only one trial lost due to a system failure. Additionally, most confounding factors were minimized within the environment of the experiment; three examples follow. First, the physical limitations of the WAR Lab did not totally preclude subjects from overhearing other's remarks. As a result, subjects had to be periodically reminded to keep crosstalk to a minimum. In general, however, the experiment's time constraints minimized idle time and kept any crosstalk to a minimum. Secondly, due to the number of participants required per trial and the experiment setting (i.e. most participants still had to attend normally scheduled classes), a full complement (four) of mail terminal volunteers was difficult to obtain for all trials. This factor likewise proved to be inconsequential as long as a volunteer was available for the CWC. Thirdly, equipment failures, such as terminal lockups and system failures, proved to be minimal and random with little or no impact on individual trials or the overall experiment.

AT NPS:

18 trials x 3.5 = 63.0 WAR Lab Hours
7 trainers x 2.0 = 14.0 WAR Lab Hours
Total = 77.0 WAR Lab Hours

Orange/control 5 x 77.0 = 385.0
DSI 2 x 66.5 = 133.0
DCA 1 x 63.0 = 63.0
Facilitators 4 x 77.0 = 308.0
Subjects 4 x 77.0 = 308.0
Volunteers 4 x 27.0 = 108.0

Total 1297.0

Preparing communications program 150.0

Installing and verifying the NWISS
scenarios and snapshots..... 175.0

Scenarios and documentation..... 120.0

AT DSI:

Experimental design, scenario
development, and analysis, etc.....1000.0+

Total Manhours > 2742.0

Figure 6.3 Manhour Requirements

6. Manhours Involved

Figure 6.3 is presented to further summarize and better demonstrate the scope of the experiment.

C. DATA COLLECTION

As previously discussed, BEAT was the methodology used to evaluate the effectiveness of our headquarters structures. The primary BEAT measures selected for the experiment could be extracted from the plans submitted and from actual firsthand observations during a trial. Data sheets were used to record these observations. A sample data sheet is included in Appendix H.

Additionally, other documentation supported the HEAT data collection process. First, since the communications program was the only authorized means of communicating, all internal communications between the Blue warfare area commanders (also between CWC and C7F) were recorded to a file and available for post-experiment analysis. Second, a 35mm slide was made of each initial snapshot, as well as any significant force positions developed during the simulation of a particular day. Third, the NWISS model provided the trace at the wargame terminal of the damage and engagement models for each wargame minute. This trace was also recorded to a file and thus available for post-experiment analysis. Fourth, NWISS provided the control position with the capability to display all NWISS generated messages directed to the Blue player terminal on the control player terminal as well. The PRTORD subsystem of the pcst-game analysis process also caused NWISS to capture and record all this traffic being displayed at the control terminal. This file was available after each trial for post-experiment analysis. Finally, the NWISS ANALYS process allowed retrieval of positional data on all forces for post-game analysis.

All of these sources of data combined provided a lucrative means of reconstructing and analyzing the trials.

VII. ANALYSIS AND CONCLUSIONS

A. OVERVIEW

This chapter presents a brief analysis of the data collected during the experiment. The main purpose of this thesis was to provide an accurate accounting of the experiment to include participation in each of the experiment's phases (design, construction, conduct, and analysis). The detailed analysis was done by DSI using HEAT. The authors' analysis efforts consisted of simple parametric and nonparametric statistical tests to validate the DSI results. The sections which follow provide a summary of these efforts, as well as some conclusions which can be drawn from the analysis. For additional details concerning the analysis, [Ref. 8] applies.

B. SUMMARY OF DSI ANALYSIS

During the experiment, selected data was collected to attempt to corroborate the findings of previous Soviet studies applicable to headquarters structures and their impact on the decision-making process. The analysis was to be done using the Headquarters Effectiveness Assessment Tool (HEAT), developed by DSI. Of the 135 HEAT measures available, those considered applicable to the experiment are shown in Figure 7.1. An initial analysis of the data showed, however, that many of these measures were either unobservable or produced results which did not differ significantly from trial to trial. As a result, many of the HEAT measures were discounted as being unserviceable, including:

DESCRIPTION OF HEAT MEASURES	SOURCES OF HEAT DATA	
	HQ PERCEPTIONS	GROUND TRUTH
12. Hypotheses about enemy objectives.	• HQ plan • Local mail traffic	• Orange script
13. No hypotheses about enemy objectives.	• HQ plan • Local mail traffic	-----
14. Hypotheses about enemy assets assigned to objectives.	• HQ plan • Local mail traffic	• Orange script
15. No hypothesis about enemy assets assigned to objectives.	• HQ plan • Local mail traffic	-----
16. Hypotheses about enemy assets assigned to reserves.	• HQ plan • Local mail traffic	• Orange script
17. No hypothesis about enemy assets assigned to reserves.	• HQ plan • Local mail traffic	-----
47. Overall ops plan for each contingent future?	• HQ plan • Local mail traffic	-----
48. Component ops plan for each contingent future?	• HQ plan • Local mail traffic	-----
51. How many overall options for most likely future?	• Local mail traffic	-----
52. How many component options for most likely future?	• Local mail traffic	-----
68. Predictions about overall ops plans.	• HQ plan • Local mail traffic	• Orange script • NWISS stats
69. Predictions about component ops plans.	• HQ plan • Local mail traffic	• Orange script • NWISS stats
91. Average time to adjust ops plans.	• DTG on mail • DTG of NWISS input	• DTG of sitrep • DTG of Orange NWISS inputs

Figure 7.1 HEAT Measures for NPS Experiment

- Measures 14 - 17 (Blue's perceptions about the enemy's use of Orange assets): Although data was available, no conclusions were drawn, probably due to the constraints on time and numbers of people available to make such assessments.
- Measures 47 - 48 (Planning alternative actions for each contingent future): The number of contingencies during a trial was always low (often only one), and thus HEAT scores from these measures did not differ substantially from trial to trial.
- Measures 51 - 52 (Number of alternative actions examined): Discussions among decision-makers were possible, but generally did not occur. Thus, these measures were not observable.
- Measures 68 - 69 (Outcome predictions): Explicit predictions were not made, even when elicited by Control.

This left three HEAT measures for use as discriminators during the different trials. These included:

- Measure 12: The percentage of time that enemy objectives were hypothesized incorrectly.
- Measure 13: The percentage of time that enemy objectives were not hypothesized.
- Measure 91: The average time required by the headquarters to adjust its operations plans.

The collection of data against each of these measures permitted the evaluation of several hypotheses, and hence, corroboration of the data previously provided by the Soviets.

The hypotheses which were examined by DSI were:

- Creative decisions are more likely to be made correctly by a fully connected structure, but more slowly than by less connected structures.
- A star structure makes decisions faster than other structures.
- Engagement decision errors are more likely to be made, and made sooner, by a star structure.

The information provided in Figure 7.2 relates to the first hypothesis. The figure shows the percent of time enemy objectives were hypothesized versus hypothesized correctly as a subset of structure, scenario, team, and sequence. Also shown is the time required to produce an initial plan, in which an estimate of enemy objectives normally appeared. The results show that the fully connected structure did actually formulate a hypothesis about the enemy objectives more often than the star, but formulated correct hypotheses slightly less often. In addition, the fully connected structure was slower overall than the star (37.2 minutes to first plan versus 35.8 minutes), but not significantly.²

For the second hypothesis (see Figure 7.2), the star structure was faster when compared to the fully connected structure, although not as fast as the partially connected case. None of the results were statistically significant.

For the third hypothesis, Figure 7.3 applies. This figure depicts the correctness of engagement decisions. A correct decision is defined as a counterattack on those forces that are actually attacking. Preemption of an imminent attack is considered correct as well. The figure shows that each structure made exactly one correct decision, each initiated hostilities two or three times, and provocations

²Significance in the DSI analysis was defined as being greater than or equal to a 90 percent confidence interval.

		PERCENT OF TIME ENEMY OBJECTIVES		
SCENARIO	TEAM AND SEQUENCE	HYPOTHESIZED (PERCENT)	HYPOTHESIZED CORRECTLY (PERCENT)	TIME TO FIRST PLAN (MINUTES)
<u>STAR STRUCTURE (CENTRALIZED)</u>				
A	A1	100	100	39
A	F2	100	100	43
B	D1	0	0	23
B	B3	0	0	39
C	C2	0	0	35
<u>PARTIALLY CONNECTED STRUCTURE</u>				
A	E1	100	100	36
A	C3	100	0	55
B	A2	100	0	39
B	F3	100	0	30
C	B1	100	0	13
C	D2	0	0	31
<u>FULLY CONNECTED STRUCTURE</u>				
A	B2	100	50	23
A	D3	100	100	34
B	C1	100	0	70
B	E2	34	34	4
C	F1	0	0	64
C	A3	100	0	28
AVERAGES:				
STAR		40	40	35.8
PARTIAL		83	17	34.0
FULL		72	31	37.2

Figure 7.2 Decision-making by Structure

were consistently and erroneously answered with full-scale counterattacks. The fully connected structures were, however, always slower (nine and three minutes respectively) to initiate hostilities mistakenly than were the other structures.

SCENARIO	TEAM AND SEQUENCE	DECISION ERROR	TIME TO PREEMPT (GAME MIN. IN DAY 6)
<u>STAR STRUCTURE (CENTRALIZED)</u>			
A	A1	None (preempted appropriately)	
A	F2	Failed to preempt attack	
B	D1	Initiated hostilities	0
B	B3	Initiated hostilities	1
C	C2	Overreacted to provocation	
<u>PARTIALLY CONNECTED STRUCTURE</u>			
A	E1	Initiated hostilities	0
A	C3	None (no combat)	
B	A2	Initiated hostilities	0
B	F3	Overreacted to provocation	
C	B1	Overreacted to provocation	
C	D2	Initiated hostilities	1
<u>FULLY CONNECTED STRUCTURE</u>			
A	B2	Overreacted to provocation	
A	D3	None (no combat)	
B	C1	Overreacted to provocation	
B	E2	Initiated hostilities	9
C	F1	Initiated hostilities	3
C	A3	Overreacted to provocation	

Figure 7.3 Engagement Decisions by Structure

C. VALIDATION OF DSI RESULTS

The authors used simple parametric and nonparametric statistical tests to validate the results obtained by DSI. The data provided by DSI (Figure 7.2 and Figure 7.3) was analyzed using statistical processes provided by MINITAB.³

³MINITAB is a general purpose statistical computing system available at the Naval Postgraduate School.

The specific statistical tests used were the Analysis of Variance (parametric) and the Mann-Whitney U-Test (nonparametric). The nonparametric test appears to be the most appropriate in that no restrictive assumptions regarding the shape of the populations were required. Additionally, the small sample size further suggested that a nonparametric test be used [Ref. 9].

In every instance, results from the Mann-Whitney U-Test verified that the data from the star structure did not differ significantly (at a 95 percent confidence interval) from that of the fully connected structure.

DATA ITEM	STRUCTURE	MEAN	S.DEV	MEDIAN
Hypothesized (%) of time	Star	40.0	54.8	0
	Partial	83.3	40.8	--
	Full	72.3	44.2	100
Hypothesized correctly (%) of time	Star	40.0	54.8	0
	Partial	16.7	40.8	0
	Full	30.7	40.8	17
Time to first plan (mins)	Star	35.8	7.7	39
	Partial	34.0	13.7	33
	Full	37.2	25.3	31

Figure 7.4 NPS Parametric Data Analysis

Parametric data (see Figure 7.4), although somewhat suspect due to the small sample size, tends to verify the DSI findings as well. These results also show that the fully connected structure did formulate a hypothesis about the enemy more often than the star structure (72.3 percent versus 40 percent), but formulated correct hypotheses less

often (30.7 percent versus 40 percent). The data is not, however, as supportive in assessing speed (i.e. time to first plan). The mean of the data tends to corroborate the DSI findings that the fully connected structure was slower overall than the star structure (37.2 minutes versus 35.8 minutes), although the median of the data directly conflicts with the findings, probably a result of the small sample size.

Two additional relationships, not discussed in the draft DSI report, were also discovered.

First, it could be argued that topologically and operationally that the partially connected and fully connected structures are not significantly different. If the data from the fully connected and partially connected structures are combined and then compared to the star structure, the results reflect the same relationships as the star versus fully connected structure comparisons.

Second, the smaller standard deviation of the star structure with respect to "time to first plan", although not statistically significant, might imply a more predictable headquarters structure.

D. CONCLUSIONS

The primary intent of the experiment, as well as the analysis was to validate several general observations documented by the Soviets, namely that different headquarters structures have predictable effects on the speed and correctness of decisions made by the headquarters.

The observed results of this experiment are consistent with the basic hypotheses that (1) star structures are generally faster, and (2) that fully connected structures are more often correct when making creative decisions.

Although the results tend to support these hypotheses, the results are by no means conclusive. The sample size was small, observations per structure (five or six) were limited, and as already mentioned some of the hypotheses remain unsupported, if not contradicted. Nonetheless, this experiment still tends to lend credence to the studies provided by the Soviets. More importantly, it serves to demonstrate a process which can be used as a foundation for future experiments of this type.

VIII. RECOMMENDATIONS

The following recommendations are provided as a result of the authors' participation in the design, conduct, and analysis of this experiment:

- NWISS is a Naval wargame and as such limited the simulation to Naval warfare. The subjects used in the experiment, on the other hand, represented all services. Accordingly, it may be undesirable to use a wargame and concept of command, with which many were unfamiliar. With respect to the experiment there are at least two ways to solve this problem, (1), use fully qualified warfare commanders from the field, and (2), use a wargame with a multi-service orientation. The logistics involved in the first make it unattractive. The second is more reasonable because such a model will soon be available. The Joint Tactical Land Simulator (JTLS), a joint air-land combat model, is particularly suited to the simulation of theater-level headquarters. This model also represents the headquarters level which HEAT was primarily designed to evaluate. Running the experiment with the JTLS model being used to stimulate the subjects would, however, result in some trade-offs. As an application of experimental-design technique, the model would improve the experiment, although the analytical effort would be more difficult, since the JTLS model does not have the array of displays and capabilities of automatically capturing data. Despite this disadvantage the authors suggest any future experiment using Joint Command, Control, and Communications curriculum students as subjects to evaluate headquarters effectiveness give stronger consideration to using the JTLS, or another multi-service oriented model.

- The level of aggregation of information in the requested plan of action did not require extensive cooperation between the warfare commanders. In fact, at times the CWC appeared to be serving as a single-node headquarters, making decisions without the benefit of his subordinate's consultation. To correct this problem, it is suggested that the plan format be designed to require information not available at the CWC position, therefore, requiring more assistance from the subordinates.
- Another problem with the planning phase (Days 1 - 5) was that the 15 minute simulations were too short. Consequently, the finished plan was often a "bare-bones" plan. Since the plan provided most of the quantifiable predictors of headquarters planning effectiveness, recommend the 15 minute intervals be expanded to allow enough planning time to permit the headquarters to provide (within the constraints of the structure being simulated) a plan representative of their capabilities. This would allow more detailed planning (a better plan), as well as more communication between warfare commanders.
- The partially connected structure did not provide the additional diversity expected in experimental headquarters structures. The restriction on the number of nodes made it difficult to design a structure significantly different from both the star and fully connected structures. We recommend the partially connected structure not be examined in future experiments to permit more testing of the two primary structures (star and fully connected).
- Finally, we recommend that the number of trials and possible Orange responses be increased to permit making statistical conclusions on the data gathered.

APPENDIX A
SCENARIO ELEMENT ORDERS

<u>ORDER</u>	<u>DESCRIPTION</u>
ENTER AIR	Enter aircraft into a scenario
ENTER BASE	Enter a shorebase into a scenario
ENTER CIRCUIT	Assign a circuit number to an existing compath in a scenario
ENTER COMMPATH	Enter a compath node into a scenario
ENTER EMCON	Enter an emission control plan for either the Blue or Orange forces into a scenario
ENTER ESM	Create a list of fingerprinted emitters which are associated with certain platforms in a scenario
ENTER MEMBER	Associate a game platform with the communication paths which it is permitted to use during the wargame play

ORDER

DESCRIPTION

ENTER ORDERS

Enter a set of unconditional orders into a scenario

ENTER PLAN

Enter a contingency plan for either the Blue or Orange forces into a scenario for player use during the wargame

ENTER REPORT

Enter a set of reporting policies which establish the primary and secondary reporting circuits and the reporting interval for platform position and logistics; and surface, air and passive track updates

ENTER SEARCH

Enter a pre-stored search plan for either the Blue or Orange forces into a scenario for player use during the wargame

ENTER SHIP

Enter a ship or submarine into a scenario by position or by a station relative to a guide at game initiation

ORDER

DESCRIPTION

ENTER SOSUS

Enter parameters governing SOSUS containment ellipses and detection probabilities by submarine class and depth in 20 non-overlapping SOSUS regions in a scenario

ENTER SURSAT

Enter the orbital parameters of surveillance satellites into a scenario

ENTER WEATHER

Enter the initial weather conditions for any of the 26 geographic regions in a scenario

APPENDIX B
TYPICAL PLAYER/CONTROL ORDERS

FORCE CONTROL ORDERS

<u>ORDER</u>	<u>PURPOSE</u>
ACTIVATE	to activate a sensor
ALTITUDE	to change altitude
BINGO	to return an aircraft to its launching unit
CANCEL	to cancel unexecuted orders
COURSE	to change course
DEPTH	to change depth of a submarine
FIRE	to fire weapons at a specified target
LAUNCH	to launch a flight

<u>ORDER</u>	<u>PURPOSE</u>
LOAD	to load expendable equipment on a flight to be launched
MISSION	to assign a mission to a flight or a ship
PROCEED COUSE	to order a unit to travel a specified number of miles
PROCEED POSITION	to order a unit to proceed to a specified position
SPEED	to change speed
SURFACE	to bring a submarine to surface
TAKE	to attack a track
WEAPONS FREE	to authorize use of weapons for offense
WEAPONS TIGHT	to authorize use of weapons for defense only

AD-A142 064

AN INVESTIGATION OF THE IMPACT OF HEADQUARTERS
STRUCTURES ON THE MILITARY COMMAND ENVIRONMENT(U) NAVAL
POSTGRADUATE SCHOOL MONTEREY CA J D OWENS ET AL.

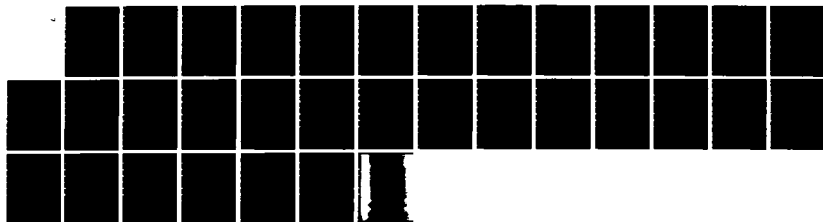
2/2

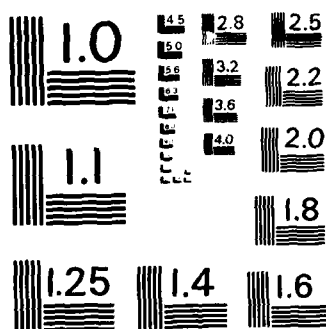
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MAR 84

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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS - 1963 - A

INFORMATION DISPLAY ORDERS

<u>ORDER</u>	<u>PURPOSE</u>
BEARING	to designate range and bearing from a source to a destination
CENTER	to center graphics displays on a platform or location
DESIGNATE	to designate a track as friendly, enemy, neutral, or unknown
LOB	to display/suppress ESM bearing lines on a graphics display
PLCT	to display selected elements on a graphics display
RADIUS	to specify the radius (area of coverage on the graphics display)

GAME CONTROL ORDERS

COPY	causes all messages to be directed to the controller's display device
------	---

<u>ORDER</u>	<u>PURPOSE</u>
DEFINE AIR	to define system failure probabilities for aircraft recovery
DEFINE ENGAGE	to define recover factor probabilities
DEFINE LAUNCH	to define the probability of a successful launch due to wind conditions for helicopters and fixed winged aircraft
DEFINE SAVE	to define the frequency of automatic database saves
END	to terminate the game
GO	to continue the game from a paused state
PAUSE	to pause the game execution
RELOCATE	to move a platform or a force to a specified location
SAVE	causes a snapshot of all volatile game data to be written to disk storage

ORDER

PURPOSE

T131

to define/redefine the number of
seconds in a game minute

APPENDIX C
EXPERIMENT ORDER OF BATTLE

Sea of Japan Blue Forces

GROUP	TASK #	NAME	CLASS	AIRCRAFT # / TYPE
CVBG	1.1.0.0	KITTY	KITTY	24 10 4 1 20 4 6 4 10 4 A7E A6E EA6B EA3B F14A F14T SH3H KA6D S3A E2C
	1.1.2.1	MCCOR	MCCOR	--
	1.1.2.2	FOX	LEAHY	--
	1.1.2.3	WILSO	DECAT	--
	1.1.2.4	LEAHY	LEAHY	--
	1.1.2.5	DECAT	DECAT	--
	1.1.3.1	SPRUA	SPRUA	2 SH2F
	1.1.3.2	RATHB	KNOX	1 SH2F
	1.1.3.3	KNOX	KNOX	1 SH2F
	1.1.3.4	BAGLE	KNOX	1 SH2F
	1.1.4.0	WICHI	WABAS	--
SUB	1.1.5.0	LOSAN	LOSAN	--
	1.1.5.1	OMAHA	LOSAN	--
BASE	1.1.6.0	MISAW	BASE	9 P3C

Sea of Japan Orange Forces

GROUP	TASK #	NAME	CLASS	AIRCRAFT # / TYPE
MINSK	5.1.0.0	MINSK	MINSK	12 15 3 FORGER HORMONE A HORMONE B
SAG A	5.1.1.0	KARA	KARA	1 1 1 HORMONE A HORMONE B HORMONE A HORMONE B
	5.1.1.1	KRES2	KARA	1 HORMONE A
	5.1.1.2	KRES1	KRES1	1 HORMONE B
	5.1.1.3	KYNDA	KYNDA	--
	5.1.1.4	KASHI	KASHI	--
	5.1.1.5	SMELY	SMELY	--
	5.1.1.6	KRIVA	KRIVA	--
	5.1.1.7	BODRY	KRIVA	--

GROUP	TASK #	NAME	CLASS	AIRCRAFT # / TYPE
-----	-----	-----	-----	-----
SAG B	5.1.2.0	KERCH	KARA	1 HORMONE A
	5.1.2.1	NIKOL	KARA	1 HORMONE E
	5.1.2.2	GOLOV	KYND	1 HORMONE A
	5.1.2.3	SPOSO	KASHI	1 HORMONE E
	5.1.2.4	SKORY	KASHI	1 HORMONE E
	5.1.2.5	SILNY	KRIVA	1 HORMONE E
	5.1.2.6	REZVY	KRIVA	1 HORMONE E
	5.1.2.7	RAZUM	KRIVA	1 HORMONE E
TATTLE- TALES	5.1.3.0	KOMSO	KASHI	1 HORMONE E
	5.1.4.0	CHARL	CHARL	1 HORMONE E
SUB	5.1.4.1	E200	ECHO2	1 HORMONE E
	5.1.4.2	E201	ECHO2	1 HORMONE E
	5.1.4.3	FOX1	FTROT	1 HORMONE E
	5.1.4.4	FOX2	FTROT	1 HORMONE E
AMPHIB	5.1.5.0	IVAN	ROGOV	1 HORMONE E
	5.1.5.1	LST10	ALLIG	1 HORMONE E
	5.1.5.2	LST11	ALLIG	1 HORMONE E
	5.1.5.3	LST12	ALLIG	1 HORMONE E
	5.1.5.4	LST20	ROPUC	1 HORMONE E
	5.1.5.5	LST21	ROPUC	1 HORMONE E
	5.1.5.6	LST22	ROPUC	1 HORMONE E
	5.1.5.7	KOT1	KOTLI	1 HORMONE E
	5.1.5.8	KOT2	KOTLI	1 HORMONE E
BASE	5.1.9.0	ALEKS	BASE	10 BADGER H
				22 BADGER C
				20 BADGER G
				32 BACKFIRE
				10 BEAR D
				10 BEAR F
	5.1.9.1	PETRO	BASE	10 BADGER C
	5.1.9.2	VLAD	BASE	1 HORMONE A
	5.1.9.3	WONSA	BASE	1 HORMONE A

Sea of Japan White (Neutral) Forces

GROUP	TASK #	NAME	CLASS
-----	-----	-----	-----
MERCH- ANT	9.1.0.0	MARU 1	MER
	9.1.0.1	MARU 2	MER
	9.1.0.2	MARU 3	MER
FISHING	9.1.1.0	FISH 1	HOOKR
	9.1.1.1	FISH 2	HOOKR
	9.1.1.2	FISH 3	HOOKR
	9.1.1.3	FISH 4	HOOKR
	9.1.1.4	FISH 5	HOOKR
SUB	9.1.2.0	PRC1	JULIE
	9.1.2.1	PRC2	JULIE

APPENDIX D

SCENARIO A DETAILED SCRIPT

DTG 022105Z APR 84
FROM: CCMSEVENTHFLT
TO: CTG 77.1
SUBJECT: SITREP NUMEER 1
THIS SETREF COVERS 011501Z-021501Z APR 84

Global Politico-Military Events

1. Substantial military activity is underway in the Soviet Union. U.S. national intelligence is still assessing the meaning of a number of confused indicators.
2. An emergency meeting of the U.N. Security Council is to convene at 0900 New York time to discuss the crisis.
3. In the light of Soviet actions, the U.S. NCA and JCS have determined to delay dispatch of any further forces to Korea at this time. U.S. 24th Infantry Division and U.S. III MAF are alerted for immediate movement, however, as are portions of U.S. PACAF air assets.

Politico-Military Events in the Northeast Asian Theater

1. General increase in Soviet military activities is shared by Soviet forces in Far Eastern military districts.
2. Chinese military activities picked up pace during the morning and became increasingly more intense during the day. U.S. intelligence assesses this to be a Chinese reaction to surprise.
3. Japan announced that the North Korean attack is unconscionable and pledged its full support to U.N. efforts to maintain the peace.

Combat Events in Korea

1. NKA forces have made little progress. They have been stalled completely in front of Seoul, which in addition to its political importance is a key transportation center. A small salient is developing in the central sector, but has not yet become dangerous.
2. NKA attacks on BOK airbases have failed to have much impact. U.S. air attacks on NKA forces at the border have experienced relatively heavy losses due to NKA air defenses.

Battle Group Actions

1. The battle group has been conducting maneuvers southeast of Hokkaido. Its position is 41N, 145E. COMSEVENTHFLT directs the CVBG to proceed

to the Sea of Japan via the Korea Strait. The CVBG is to rendezvous en route with fuel and supply ships that will sortie Yokosuka. The at-sea meeting will occur at 33N, 140E 48 hours hence.

2. COMSEVENTHFLT also directs the CVBG to prepare and submit a plan of action for execution upon arrival in the Sea of Japan. The primary mission of the CVBG will be to provide support for U.N. forces ashore in Korea. However, the CVBG may also be called upon to maintain SLOC between Korea and Japan, and to conduct self-defense at its own discretion. The CVBG is to submit plan updates as it deems appropriate.
3. A KASHIN DDG observing the maneuvers follows the CVBG as it moves south.

DTG 032110Z APR 84
FROM: CCMSEVENTHFLT
TO: CTG 77.1
SUBJECT: SITREP NUMBER 2
THIS SETREF COVERS 021501Z-031501Z APR 84

Global Politico-Military Events

1. U.S. intelligence has made the following assessment of Soviet military actions outside of NE Asian Theater:
 - (a) Strategic Rocket Forces (SRF) have gone to their lowest state of alert.
 - (b) All Groups of Soviet Forces in Eastern Europe and all Warsaw Pact active forces have been placed in a high state of readiness. Frontal Aviation forces are similarly alert.
 - (c) All category I divisions (i.e., fully combat ready) in the European military districts of the USSR have been placed on the same high state of readiness. Frontal Aviation units in the same area are at a low alert level.
 - (d) Long Range Aviation (LRA) and Military Transport Aviation (VTA) activities are unclear. Aeroflot activities appear to be normal.
 - (e) National air defense activities reflect the highest state of readiness.
 - (f) Northern Fleet activities are intense, but the meaning of this is unclear. The Baltic Fleet and Black Sea Fleet have been placed on a high state of readiness. The Fifth Eskadra in the Mediterranean has departed all anchorages and appears to be forming groups at sea.
2. The U.N. Security Council is continuing to meet in New York. These events have occurred:
 - (a) The representative of the DPRK has stated that his country is merely acting to remove an intolerable threat of aggression to his country. He pledges that no further action is contemplated after the destruction of the criminal South Korean regime.
 - (b) The representative of the ROK has stated that his country is the victim of a long premeditated attack and accuses the Soviets of pushing the DPRK into it. He asserts that his country's forces are doing well and will defeat aggression.
 - (c) The Soviets support the DPRK strongly, saying that the ROK is a puppet of the U.S. and a great threat to world peace. The DPRK, they claim, is merely ending an imperialist farce which had been inflicted too long on the world.
 - (d) The United States delegate made clear that the U.S. will carry out the U.N.'s mandate to maintain the peace in NW Asia to the utmost of its ability.

3. NATC is meeting to discuss the meaning of Soviet actions.
4. The U.S. NCA and JCS have determined that an additional tactical fighter wing should be sent to the ROK from Hawaii and be replaced in Hawaii by one from CONUS. Further deployments are deferred awaiting developments in Europe.

Politico-Military Events in the Northeast Asian Theater

1. Soviet military activities have been assessed as follows:
 - (a) All category I divisions in the Far Eastern military district have been brought to a high state of alert.
 - (b) The meaning of LRA activity remains unclear. Frontal Aviation has gone to a low-level alert, but appears to be maintaining much of its peace-time activities.
 - (c) National air defense activities reflect the highest state of readiness.
 - (d) A strong surface action group has sortied Vladivostok. Amphibious shipping appears to have moved to an area of loading docks. SNA activity has dropped to near zero, except for reconnaissance fighters, which have doubled from their normal levels.
2. Chinese military activities continue to intensify. Intelligence assesses this as potentially preparation to mobilize the country. China has withheld comment in the U.N. Security Council, but is scheduled to make a statement later today.

Combat Events in Korea

1. NKA forces continue to make little progress. They deepened the salient in the central sector and are pushing through defenses on the east coast.
2. NKAF efforts continue to meet little success. U.S. and ROK air attacks are successful whenever they can find exposed NKA troops, but losses continue to mount.

Battle Group Actions

1. The CVBG is moving toward its rendezvous with the support ships. Current position is 37N, 143E.
2. The KASHIN DDG continues to follow along.

DTG 042055Z APR 84
FROM: CCMSEVENTHFIT
TO: CTG 77.1
SUBJECT: SITREP NUMBER 3
THIS SETREF COVERS 031501Z-041501Z APR 84

Global Politico-Military Events

1. U.S. intelligence has made the following assessment of Soviet military actions outside of NE Asian Theater over the past 24 hours:
 - (a) SRF have maintained their low state of alert. However, an unknown, but possibly large, number of SSBNs have sortied their Northern Fleet base.
 - (b) All Groups of Soviet Forces in Eastern Europe and all Warsaw Pact active forces continue in a high state of readiness. Frontal Aviation forces remain similarly alert. There are many indicators present similar to those seen when a major field exercise is about to commence.
 - (c) All category I divisions and Frontal Aviation units in the European military districts of the USSR remain at a high state of alert and similarly seem to be preparing for major field exercises.
 - (d) LRA and VTA activities remain unclear. Some evidence suggests that a few small units have begun shifting to the Far East.
 - (e) Northern Fleet activity remains intense. Units sufficient to compose at least one strong surface action group have sortied from Kola Inlet. The Kiev CVSG is believed to still be in the Kola, however. Baltic and Black Sea Fleets are maintaining their high state of alert. Fifth Eskadra in the Mediterranean has formed three major groups of ships; several ships currently sailing independently appear to be heading for a rendezvous with the three; a marker has begun keeping company with the U.S. CVBG presently in the Mediterranean.
2. The U.N. Security Council is continuing to meet in New York. These major events have occurred:
 - (a) China has stated its policy on the crisis as follows. The PRC will not calmly see its interests violated. While the ROK is a bourgeois tyranny, the DPRK's attack on it is undertaken at the behest of the Soviets and is intended to spread USSR's hegemony. This can only injure the interests of world peace and especially those of the peace-loving Chinese people. However, also in the interests of world peace, the PRC will not expand the area of conflict outside the Korean peninsula if it is forced to discipline the aggressors.
 - (b) The Japanese ambassador to the U.N. announced that Japan has been approached by the USSR and asked to deny the U.S. use of its bases and airspace. The Soviets are further reported to have stated that they realize that Japan has long been bullied by the U.S. and that it will

extend its fraternal protection to the Japanese people if they will comply with their wishes. They have assured the Japanese that the DPRK wishes only the best and most profitable relations with Japan. Japan categorically rejects these representations and will lend all assistance to the U.N. which is in consonance with its constitution and its treaty obligations. At the same time, not to inflame the situation further, Japan's Self-Defense Forces have been placed only on their lowest state of alert. Further, Japan has asked the Soviets to use their good offices to bring the DPRK to end its aggression and seek negotiations to stop the fighting. For its part, Japan will attempt to do the same with the United States and the ROK.

(c) The Soviet ambassador made three points.

- i) Any military activity currently being undertaken by the USSR is only in preparation by its peace-loving peoples for their self-defense, contrary to the lies and slanders found in the Western press.
- ii) With regard to the defensive actions now being taken by the DPRK: these actions are entirely just and laudable in that they seek to liberate half a nation long oppressed by imperialism, and the USSR will do all that is necessary to see that the DPRK succeeds in its task.
- iii) Japan's actions allowing the U.S. to continue use of its soil and airspace to oppress the Korean people are most regrettable, and contrary to the true interests of the Japanese people. Since the Japanese government will not act responsibly, the Soviet government must do so, and Japan will suffer the consequences if it clings too long to outmoded patterns of action in a changing world.

3. NATO declared a medium state of alert.

4. The U.S. NCA and JCS decided that it must maintain a capability to execute PEFORGER/CRESTED CAP quickly. This automatically limits the rapidity of the build-up in the ROK. CINCLANTFLT directed CONSECONDFLT to sortie his carriers and begin preparations for operations in the Norwegian Sea. CINCPACFLT directed COMTHIEDFLT to move his CV's from San Diego to Pearl Harbor. 24th Infantry Division is directed to embark and proceed ROK, as is III MAF.

Politico-Military Events in the Northeast Asian Theater

1. Soviet military activities in-theater have been assessed as follows:

- (a) SRF generally maintains its low state of alert. All SS-20 units are showing increased signs of activity, however, meaning unclear. A large number of SSBNs have sortied Petropavlovsk.

- (b) All category I divisions in the Far Eastern MD remain at a high state of alert and appear to be preparing for a major field exercise.
 - (c) IRA activity has almost ceased. This may be a stand-down preparatory to some action. Frontal Aviation appears to be maintaining its quasi-alert status.
 - (d) National air defense is maintaining high readiness.
 - (e) A strong Soviet SAG has been sighted off the west coast of Hokkaido. Amphibious shipping remains at dockside. A number of submarines (SS, SSN, SSGN) are believed to have sortied Vladivostck. SNA remains a stand-down, except for recce and ASW flights.
 - (f) An additional surface action group has sortied Vladivostck.
2. Chinese military activities continue to intensify. The following assessment of some of their activities has been made:
- (a) People's Liberation Army (PLA) strategic forces have gone to a low state of alert.
 - (b) PLA ground forces all along the Korean border and into the depths of Manchuria have assumed the highest state of alert. Forces immediately along the Sino-Soviet border have moved only to a low state of alert, however.
 - (c) PLA air force units have begun concentrating on northern bases.
 - (d) PLA naval movements of DDG and fast attack craft (FAC) from the south up toward the north have begun. Movement is generally coastal. A number of SS are believed to have sortied.

Combat Events in Korea

- 1. NKA forces continue to make little progress. The central salient has come under counterattack and may be pinched cut. The east coast thrust has continued to advance, but appears to be taking heavy losses from air attack.
- 2. NKAF efforts have changed over to largely air defense of the troops. U.S. and ROK air attacks continue to take substantial losses.

Battle Group Actions

- 1. The CVBG meets its supply ships at 33N, 140E as scheduled. The KASHIN DDG continues to observe.

DTG 052110Z APR 84
FROM: CCMSEVENTHFLT
TO: CTG 77.1
SUBJECT: SITREP NUMEER 4
THIS SETREF COVERS 041501Z-051501Z APR 84

Global Politico-Military Events

1. U.S. intelligence has made the following assessment of Soviet military actions outside the NE Asian Theater over the past 24 hours:
 - (a) SRF have maintained their low state of alert. Almost all SSBNs have now sortied Polliarniye and are now either at sea or at dispersal bases in the vicinity of the Kola Inlet.
 - (b) GSFs and Warsaw Pact forces have begun major field exercises. Frontal Aviation has joined the exercises, but is maintaining many units at a 100% stand-down.
 - (c) All category I divisions in the USSR are maintaining their high state of alert, as are Frontal Aviation units.
 - (d) LRA and VTA have both commenced transfer of forces to the Far East at a slow rate.
 - (e) Two, and possibly three, strong SAGs have been formed by Northern Fleet. All have remained in the Barents. A major anti-carrier warfare exercise appears to have commenced. KIEV appears to have sortied from Murmansk. Baltic and Black Sea Fleets are maintaining a high state of alert. Fifth Eskadra has closed up into three groups, one of which appears to have begun an ACW exercise. A second marker, armed with anti-ship cruise missiles, has joined company with the U.S. CVBG presently in the Mediterranean.
2. The U.S. Security Council has adjourned for a day, given that no progress has been made in stopping the fighting.
3. NATC maintains its forces at a medium state of alert.
4. U.S. 24th Infantry Division and III MAF began embarking for RCK.

Politico-Military Events in the Northeast Asian Theater

1. Soviet military activities in-theater have been assessed as follows:
 - (a) SRF has maintained its low state of alert, except for all SS-20 units, which are now at maximum alert. All SSBNs have sortied Petropavlovsk and are either at sea or at dispersal bases in the Sea of Okhotsk.
 - (b) The Soviet Far Eastern Military District has begun a large-scale field exercise.
 - (c) LRA activities continue at an extraordinary low level. Frontal Aviation has joined the ground forces' exercises with some units; others have

left their peacetime routine and appear to have gone to a high state of alert.

- (d) National air defense is maintaining a high readiness status.
 - (e) The two Soviet SAG's are reported to have rendezvoused at approximately 40N, 134E.
2. Chinese military activities appear to have leveled off at a high level. The following assessment of their actions over the past 24 hours has been made:
- (a) PLA strategic forces have gone to a low state of alert.
 - (b) PLA ground forces along the Korean border have maintained their alert status. Forces in the depths of Manchuria appear to be preparing a major exercise. Forces along the Sino-Soviet border maintain a low state of alert.
 - (c) PLA air force units continue to concentrate in the north.
 - (d) PLA naval movements of DDG and FAC up the coast have continued. ROK fishermen have informed KCIA that they spotted a surfaced submarine, assessed to be Chinese, in the Yellow Sea.

Combat Events in Korea

- 1. NKA forces continue to make little progress. Reserves have been committed on both the west and east coasts: some advances have been made toward Seoul. On the east coast heavy casualties have been inflicted on a ROK division holding the main coastal road.
- 2. NKAF efforts appear to be flagging. U.S. and ROK air losses have been substantial, and attempts to strike DPRK air bases have been suspended.
- 3. U.S. CIA sources report that DPRK has been badly surprised by the depth and strength of ROK resistance. It is believed that a delegation of DPRK officials has arrived in Moscow--purpose of visit unknown.

Battle Group Actions

- 1. The CVBG accompanied by supply ships and the KASHIN DDG, is now at 29N, 131E.

DTG 062050Z APR 84
FROM: COMSEVENTHFLT
TO: CTG 77.1
SUBJECT: SITREP NUMBER 5
THIS SETREF COVERS 051501Z-061501Z APR 84

Global Politico-Military Events

1. Soviet activities in the various European theaters have remained unchanged from the last report. Intense field and sea exercises are continuing.
2. LRA and VTA are continuing transfer of forces to the Far Eastern theater at a low rate.
3. The U.N. Security Council met briefly today. Essentially nothing new was said. The USSR reiterated that Japan was taking an ever more active role in the oppression of the Korean people, and would have to face the consequences of the anger of all justice-loving peoples of the world if it did not cease its actions.
4. U.S. NCA and JCS have decided to transfer two U.S. tactical fighter groups to Korea.

Politico-Military Events in the Northeast Asian Theater

1. Soviet activities in-theater remain unchanged from last report, with the exceptions as noted:
 - (a) SS-20 units appear to have begun a major exercise. LRA units in-theater appear to be preparing to join them.
 - (b) Naval infantry units appear to be concentrating near Vladivostok. Number and composition are unclear.
 - (c) The combined Soviet SAG's have been reported at 40N, 132E.
 - (d) Groups of strike-type aircraft have been observed proceeding from Soviet territory to the DPRK, flying along the coast.
2. Chinese military forces continue intense activity. These changes appear to have occurred over the past 24 hours:
 - (a) PLA ground forces have begun a major exercise. It appears to be concentrated in the mountainous areas of N. Manchuria.
 - (b) PLA air force movements are slowing, as the concentration appears to be nearing completion.
3. Both Korea and Japanese fishing vessels have reported sighting an unidentified conventional submarine on the surface at night in the vicinity of the Korea Strait.

Combat Events in Korea

1. NKA forces have penetrated ROK defenses north of Seoul after the NKA committed reserves there. Mobile battles are proceeding just south of the ROK border defense belt. On the east coast NKA forces

have made slow but steady progress against weakened defenses.

2. No change in the air situation.
3. Chinese sources report that a high-level Soviet military delegation flew to Pyongyang. Army, Frontal Aviation, and Navy general officers were seen. Chinese speculation is that the Soviets are discussing ways and means to help the DPRK.

Battle Group Actions

1. The CVEG has passed through the Korea Strait and is now located at 35N, 130E. The Soviet KASHIN marker is still trailing along. The CVEG has been overflown by a section of Badger recce aircraft.
2. COMSEVENTHFLT requests an update on the CVEG's plans for operations.

DTG 072055Z APR 84
FROM: COMSEVENTHFLT
TO: CTG 77.1
SUBJECT: SITREP NUMBER 6
THIS SETREF COVERS 061501Z-071501Z APR 84

Global Politico-Military Events

1. There has been a substantial intensification of military activity throughout the Soviet Union. Major field and sea exercises are being held in the Barents, Baltic, Black, and Mediterranean Seas, the Kola Peninsula, East Germany, and the Ukraine.
2. The U.N. Security Council met today to hear statements by the Soviet Union and China. They were as follows:
 - (a) The Soviet ambassador warned all who were interfering with the Korean liberation that they must stop their nefarious deeds immediately. He particularly pointed to the U.S. as the mainspring of aggression against the Korean peoples. He yet again appealed to Japan to end U.S. use of its airspace and bases, noting that, if the Japanese people would stand up to the U.S. and refuse to be the tool of imperialism, they need not fear retaliation. The Soviet Union would stand by Japan until the end.
 - (b) The Chinese ambassador appealed to the peoples of the world to see the Soviets for what they really were. He stated that soon the Soviets would be on the attack in Europe and elsewhere, bidding for world hegemony.
3. U.S. embassy, Japan reports that there have been large street demonstrations by leftists. They demand that Japan stop trying to trigger nuclear holocaust and start acting as a neutral in the current dispute.

Politico-Military Events in the Northeast Asian Theater

1. Amphibious shipping carrying naval infantry and a motor-rifle unit has sortied Vladivostok and is transiting toward Sakhalin.
2. Still larger and more numerous groups of aircraft have been observed flying along the coast from the USSR to the DPRK.

Combat Events in Korea

1. NKA forces outside Seoul appear to be receiving reinforcements. Heavy attacks have begun in the central sector again, and have made some progress on the western flank. NKA efforts on the east coast were being renewed late in the reporting period; a number of SAM sites have been located in the immediate rear of NKA frontline in that area.
2. Strong NKAP air attacks were made on Seoul and the central sector and suffered considerable losses. U.S. and ROK close air support of the central sector has incurred some casualties from NKA SAMs inside the DPRK.

3. CIA sources in Eastern Europe report that the DPRK has placed heavy pressure on the USSR to provide more support. The sources claim that the North Koreans fear that the NKA/NKAP will collapse suddenly within next 7-10 days and that DPRK may be destroyed as a result.

Battle Group Actions

1. COMSEVENTHFLT advises that battle group should be alert to act against either of two apparent major Soviet options:
 - (a) attacks on shipping in Japan-Korea SLOC (Strait of Shimonoseki-Pusan); or
 - (b) military action against Japan.

In either case the battle group is the first line of defense and may be attacked directly. Situation may begin to change rapidly at any time, and CVBG may not receive superior direction in time to react appropriately. CWC is therefore authorized to act as he sees fit in accordance with the circumstances as he perceives them.

2. Soviet KASHIN battletale has broken off trail for unknown reason. It departed suddenly and at high speed.
3. Previously sortied Soviet submarines are believed to be in the Sea of Japan, but their locations are unknown.
4. The two Soviet SAG's that previously sortied Vladivostok are still located near 40N, 132E.
5. COMSEVENTHFLT advises that the two SAG's have not merged, but have retained distinct individual formations side-by-side. Their initial maneuvers suggest that their intent may be to conduct Blue-Orange exercises.
6. COMSEVENTHFLT also advises that the battle group is expected to provide close air support to U.N. forces ashore in Korea at its earliest convenience. The battle group is now at 39N, 130E. COMSEVENTHFLT requests an information copy of the CVBG plans as soon as they are ready.

ORANGE SCRIPT FOR SCENARIO A' (DAY 6 OF SCENARIO A)

At the beginning of game play, the position of forces is as follows:

Orange Tracks

SAG A	40N, 132E				
SAG B	40N, 132E				
Amphib.	43N, 135E	course 045	speed 10		
KASHIN A	39N, 130E	000	20		
KASHIN B	42N, 132E	180	20		
Tattle Sub:	20 nmi from Blue CV, same course and speed				
SSGN attack group	38N, 130E	course 010	speed 5		
Air attack group A	40N, 128E	course 130	speed 500		
Air attack group B	41N, 130E	course 180	speed 500		

Blue Tracks

CVBG 39N, 130E course 350 speed 5

ORANGE actions are as follows:

- (1) At t=005 minutes, perform the following:
 - (a) Air attack group A to course 180
 - (b) Air attack group B to course 225
 - (c) SAGs A and B to course 240 speed 20
- (2) As the game progresses, have air attack groups A and B continue to wheel around the CVBG in counterclockwise maneuver, staying at least 100 nmi from the CVBG.
- (3) At t=025 minutes, one of three events occurs:
 - (a) For experimental groups A and F, all ORANGE units attack.
 - (b) For experimental groups B and E, KOMSO launches its missiles at the CVBG. Other ORANGE forces do nothing, unless the CVBG attacks either the air group(s) or the SAG(s). If CVBG launches any such attack, then all ORANGE forces engage.
 - (c) For experimental groups C and D, nothing whatever happens. The air groups A and B continue to wheel around the CVBG and, when reaching course 000, head home. If the CVBG attacks any ORANGE unit, then all ORANGE units attack the CVBG.

APPENDIX E
SAMPLE ORANGE FORCES SCENARIO CHECKLIST

CHECKLIST SCENARIO A' (a) (GROUPS A AND F)
(ORANGE PRE-EMPTIVE STRIKE)

TIME = 0000R => 0045Z

- 1) DECM ON
- 2) HBCC CN
- 3) PLACE (a) GRID (around) FORCE KITTY (with radius) 25
- 4) PLACE (a) CIRCLE (around) FORCE CHARL (with radius) 5

TIME = 0005R => 0050Z

- 5) CNTRL F (filename) A6AC180.PRE => air attack group A
to course 180 speed 500
- 6) CNTRL F (filename) A6BC225.PRE => air attack group B
to course 225 speed 500
- 7) FOR NARA COURSE 240
- 8) SPEED 20
- 9) FOR MERCH COURSE 240
- 10) SPEED 20

TIME = 0010R => 0055Z

- 11) CNTRL F (filename) A6AC135.PRE => air attack group
A to course 135

TIME = 0023R => 0108Z

- 12) CNTRL F (filename) A6BC135.PRE => air attack group
B to course 135

TIME = 0025R => 0110Z

- 13) FOR 5.1 WEAPONS FREE ALL
- 14) Execute first wave actions

- a) Group B aircraft (35 cruise missiles/wave = 142 missiles total)
- (1) Use BDXXX and BRXXX - BR507
 - (2) Keep tally of missiles/wave and total
 - (3) Determine bearing/range and give FIRE command
 - (4) Fire 35 cruise missiles
- ex: BEARING (and range from) FORCE BRXXX
tc FORCE KITTY
- FCR BRXXX FIRE X XXX CRUISE (missiles)
BEARING XXX RANGE XXX
- ***BDXXX and BRXXX - BR507 for Group B***
*****BR508 - BRXXX for Group A*****
- b) SAG A (5 cruise missiles/wave = 20 missiles total)
- (1) Use KRFS1 and KYNDA
 - (2) Keep tally of missiles/wave and total
 - (3) Determine bearing/range and give FIRE command
 - (4) Fire 5 cruise missiles
- ex: BEARING (and range from) FORCE XXXX
tc FORCE XXXX
- FCR XXXX FIRE X XXX CRUISE (missiles)
BEARING XXX RANGE XXX
- c) Group A aircraft (30 cruise missiles/wave = 112 missiles total)
- (1) Use BR508 - BRXXX
 - (2) Keep tally of missiles/wave and total
 - (3) Determine bearing/range and give FIRE command (see example above)
 - (4) Fire 30 missiles
- d) SAG B (4 cruise missiles/wave = 16 missiles total)
- (1) Use GOLCV
 - (2) Keep tally of missiles/wave and total
 - (3) Determine bearing/range and give FIRE command (see example above)
 - (4) Fire 4 cruise missiles
- 15) Between waves do the following:
- a) Check CHARL 5 mile radius for target(s)
 - b) If target(s), check ACTIVE TRACK Status Board for track number
 - c) If track number, issue FIRE command (8 torpedoes per wave = 32 torpedoes total)
- ex: FOR CHARL FIRE X XXX TORPEDO (at) track-nc
- d) Keep tally of torpedoes/wave and total
 - e) Fire 8 torpedoes
 - f) CHECK WHEELING AIRCRAFT!!!!!!!!!!!!!!!!!!!!!!
- air attack group A
- A6AC045.FRE => course 045
A6AC000.FRE => course 000 speed 250

air attack group B

A6BC045.FRE => course 045
A6BC000.FRE => course 000

TIME = 0040R => 0125Z

16) Repeat steps 14 and 15

TIME = 0055R => 0140Z

17) Repeat steps 14 and 15

TIME = 0110R => 0155Z

18) Repeat steps 14 and 15

APPENDIX F

EXPERIMENT RESPONSIBILITIES

Defense Systems, Inc. (DSI) Responsibilities

As overall developer of the experiment, DSI provided the following experimental support:

- Prepared a memo confirming status and responsibilities of the experiment participants.
- Developed scenarios, headquarters structures, and determined experimental sequence based on the the number of student groups participating.
- Prepared a streamlined plan format for use by the headquarters to transmit its plans to the experiment's control node via an electronic mail system.
- Prepared a classroom presentation to introduce the experiment to student participants at NPS.
- DSI will also prepare a final in-depth analysis of all data to determine the effects of structure on headquarters effectiveness and draw conclusions relative to this experiment as compared to the Soviet experiments previously described.

Naval Postgraduate School (NPS) Responsibilities

As facilitators of the experiment, NPS provided the following experimental support:

- Provided and converted the NPS WAR Lab to support the experiment.

- Prepared and installed a representative Soviet Naval order of battle on the NWISS.
- Installed a series of time-phased "snapshots" representative of each of the situation reports used to develop each of the scenarios.
- Developed and installed an electronic mail capability to support testing of each network structure.
- Converted DSI prepared Orange forces (Soviet) scenarios into detailed NWISS supported scripts.
- Identified a student sample to support the conduct of the experiment.
- NFS will draw general conclusions about the experiment.

APPENDIX G **EXPERIMENT SCHEDULE**

WISS GROUP	B	E	A	D TRAINER	E	D	A
RUN DATE	7 NOV	7 NOV	8 NOV	8 NOV	9 NOV	9 NOV	10 NOV
START TIME	1100	1700	1300	1730	1400	1730	1200
FINISH TIME	1300	1900	1630	2000	1730	2100	1530
EXP GROUP MEMBER	CMC: SOMERS	SOMERS	D. OWENS	WHITNEY	CARLSON	WHITNEY	SCHULTZ
	AM: MCQUINNNESS	MCQUINNNESS	RISNEY	BEAVER	WHITWORTH	BEAVER	O'BRYANT
	ASH: CONRAD	CONRAD	O'BRYANT	FARNSWORTH	BIGELON	FARNSWORTH	D. OWENS
	ASUN:		SCHULTZ	WRIGHT	MCCOY	WRIGHT	RISNEY
LEAD GROUP MEMBER	#1 TOMBRELLA	TOMBRELLA	MARTIN	TOMBRELLA	MARTIN	VOGAN	SHAWA
	#2 VOGAN	LANE	SHAWA	HALLAGAN	SHAWA	ELMLINGER	VOGAN
	#3 HARRIS	HARRIS	VOGAN	VOGAN	ELMLINGER	HARRIS	LANE
	#4 ELMLINGER	VOGAN	LANE	ELMLINGER	VOGAN		ELMLINGER
JC-41 VOLUNTEER (e these times only)	#1 N/R	PETTERSON	JOHNSON	N/R			AMBROSE
	#2 N/R	JASKOT	AMBROSE	N/R			
	#3 N/R	YOUNG	JASKOT	N/R			
	#4 N/R			N/R			
	*	1700-1830	1430-1600		1530-1700	1900-2030	1330-1500
CONTROLLER	#1 BROWN	BROWN	BROWN	BROWN	BROWN	BROWN	BROWN
	#2 J. OWENS	J. OWENS	J. OWENS	J. OWENS	J. OWENS	J. OWENS	J. OWENS
	#3 PORTER	PORTER	PORTER	PORTER	PORTER	PORTER	PORTER
HEAT OBSERVER	#1 STRACK	STRACK	STRACK	STRACK	STRACK	STRACK	STRACK
	#2 KIRZL	KIRZL	KIRZL	KIRZL	KIRZL	KIRZL	KIRZL

MISS GROUP	F	C	B	C	A	A	D
RUN DATE	10 NOV	11 NOV	11 NOV	14 NOV	15 NOV	15 NOV	15 NOV
START TIME	1500	0800	1200	1400	0800	1300	1730
FINISH TIME	1900	1200	1530	1730	1000	1500	2100
EXP GROUP MEMBER	CAC: LINSTADT	BADGER	MCQUINN	TSUDY	RISNEY	RISNEY	WRIGHT
AAH: TRIVETTE	CUSH	CONRAD	BADGER	BADGER	D. OWENS	D. OWENS	FARNWORTH
ASH: RODRIGUEZ	LOMBARDO	BROWN	CUSH	CUSH	SCHULTZ	SCHULTZ	BEAVER
ASUN: CLEVELAND	TSUDY	SONERS	LOMBARDO	LOMBARDO	O'BRYANT	O'BRYANT	WHITNEY
LEAD GROUP MEMBER #1	SHAWA	HARRIS	HARRIS	VOGAN	LANE	TOMBRELLA	SHAWA
#2	LANE	TOMBRELLA	TOMBRELLA	SHAWA	HARRIS	MARTIN	MARTIN
#3	HARRIS	VOGAN	VOGAN	LANE	TOMBRELLA	LANE	HALLAGAN
#4	TOMBRELLA	HALLAGAN	PORTER	HALLAGAN	ELMLINGER	ELMLINGER	ELMLINGER
JC-41 VOLUNTEER (* these times only)	#1 PETERSON	HENRY	YOUNG	SHART	N/R	JOHNSON	SHART
#2 SHART	MANSON	BREIDERT	BREIDERT	MALOKAS	N/R	BREIDERT	AMBROSE
#3 HENRY	JOHNSON	JOHNSON	JOHNSON	---	N/R	MALOKAS	PETERSON
#4 YOUNG	---	---	---	---	N/R	YOUNG	MANSON
* 1700-1830	1000-1130	1330-1500	1530-1700	1900-2030	1300-1430	1900-2030	1900-2030
CONTROLLER	#1 BROWN	BROWN	BROWN	BROWN	BROWN	BROWN	BROWN
#2 J. OWENS	J. OWENS	J. OWENS	J. OWENS	J. OWENS	J. OWENS	J. OWENS	J. OWENS
#3 PORTER	PORTER	PORTER	PORTER	PORTER	PORTER	PORTER	PORTER
HEAT OBSERVER	#1 STRACK	STRACK	STRACK	STRACK	STRACK	STRACK	STRACK
#2 KIRZL	KIRZL	KIRZL	KIRZL	KIRZL	KIRZL	KIRZL	KIRZL

MISS GROUP	E	D	C	F	B	F	E
RUN DATE	16 NOV	16 NOV	17 NOV	18 NOV	18 NOV	22 NOV	23 NOV
START TIME	1400	1730	1300	1000	1330	1400	1400
FINISH TIME	1730	2100	1630	1330	1700	1730	1730
EXP GROUP MEMBER	CAC: BIGELOW	FARNSWORTH	LOMBARDO	CLEVELAND	CONRAD	RODRIGUEZ	MCCOY
	AM: CARLSON	WRIGHT	TSAUDY	RODRIGUEZ	BROWN	CLEVELAND	BIGELOW
	ASH: MCCOY	WHITNEY	BADGER	LINNSTAEDT	SOMERS	TRIVETTE	WHITWORTH
	ASUN: WHITWORTH	BEAVER	CUSH	TRIVETTE	MCGUINNESS	LINNSTAEDT	CARLSON
LEAD GROUP MEMBER	#1: SHAWA	MARTIN	MARTIN	TOMBRELLA	LANE	MARTIN	VOGAN
	#2: MARTIN	TOMBRELLA	SHAWA	LANE	HALLAGAN	HALLAGAN	MARTIN
	#3: LANE	HARRIS	TOMBRELLA	HALLAGAN	HARRIS	SHAWA	HALLAGAN
	#4: VOGAN	LANE	ELMLINGER	ELMLINGER	ELMLINGER	TOMBRELLA	HARRIS
JC-41 VOLUNTEER (* these times only)	#1: _____	YOUNG	AMBROSE	MALDKAS	HENRY	HENRY	SMART
	#2: _____	PETTERSON	PETTERSON	_____	MALDKAS	SMART	_____
	#3: _____	_____	HENRY	_____	_____	PETTERSON	_____
	#4: _____	_____	BREIDERT	_____	_____	YOUNG	_____
	* 1530-1700	1900-2030	1430-1600	1130-1300	1500-1630	1530-1700	1530-1700
CONTROLLER	#1: BROWN	BROWN	BROWN	BROWN	_____	BROWN	BROWN
	#2: J. OWENS	J. OWENS	J. OWENS	J. OWENS	J. OWENS	J. OWENS	J. OWENS
	#3: PORTER	PORTER	PORTER	PORTER	PORTER	PORTER	PORTER
HEAT OBSERVER	#1: STRACK	STRACK	STRACK	STRACK	STRACK	STRACK	STRACK
	#2: KIRZL	KIRZL	KIRZL	KIRZL	KIRZL	KIRZL	KIRZL

DECISION (DIRECTION) SCORING SHEET (CODE D)

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